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CONFERENCE

IN THE MATTER OF THE POLLUTION OF THE NAVIGABLE WATERS OF GALVESTON BAY AND ITS TRIBUTARIES (TEXAS)

Houston, Texas

June 7 - 12, 1971

TRANSCRIPT OF PROCEEDINGS

CONTENTS

PAGE

Opening Statement - By Murray Stein 1

STATEMENT OF:

The Honorable Bob Eckhardt, U. S. House of Representatives 12

The Honorable Bill Archer, U. S. House of Representatives (Read by Don Jansen.) 123

The Honorable Rex Braun, Representative, State of Texas 125

Richard Vanderhoof 131

Malcolm Kallus 134

Thomas P. Gallagher 141

Dr. Clark Allen 372

Jerry Thornhill 374

Kenneth Kirkpatrick 380

Ancil Jones 383

George Putnicki 388

Dr. Clarence Tarzwell 402

Victor Casper 419

Jack Rawson 433

CONTENTS (Continued)

	PAGE
Opening Statement - By Murray Stein	436
STATEMENT OF:	
Gordon Fulcher	441
Josiah Wheat	471
John Quarles, Jr.	478
Hugh Yantis, Jr.	492
Dr. Dudley Johnson	508
Dr. Carl Oppenheimer	549
Terrance Leary	582
Dick Whittington	591
Bob Fleming	682
B/G Royal Hatch, USAF Rtd.	689
Sal Lamprose	711
Cecil Reid	721
Ed Falk	725

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Opening Statement - Murray Stein

CHAIRMAN STEIN: The conference is open.

This conference in the matter of pollution of the navigable waters of Galveston Bay and its tributaries, involving the State of Texas and the United States Environmental Protection Agency is being held under the provisions of Section 10 of the Federal Water Pollution Control Act.

Under the provisions of the Act, the Administrator of the Environmental Protection Agency is authorized to call a conference of this type when he finds that substantial economic injury results from the inability to market shellfish or shellfish products in interstate commerce because of pollution subject to abatement under the Federal Act, and action of Federal, State, or local authorities.

The purpose of the conference is to bring together the State water pollution control agency, representatives of the U. S. Environmental Protection Agency, and other interested parties to review the existing situation and the progress which has been made, to lay a basis for future action by all parties concerned, and to give the State, localities, and industries an opportunity to take any indicated remedial action under State and local law.

And I would like to emphasize what I have just said and go over that because, since arriving in Houston last night, there were some indications that this may not be thoroughly understood.

It should be recognized that a lot of people were working on this pollution problem, or the quality of the water problem in Texas, and particularly in the Houston Ship Channel long before the Federal Government decided to hold the conference.

When we say we are going to review the existing situation and the progress which has been made, we mean just that.

We also are going to try to arrive -- by the conference technique which has worked successfully in the past -- at a fairly clear statement of facts because I don't think we can all move forward unless we have a reasonable agreement on the facts by almost all the parties concerned.

Therefore, I would ask anyone to withhold judgment. I certainly will. I am approaching this with an open mind.

I ask you to withhold judgment on what the factual situation is, what has or has not been done, until we have an opportunity to have heard all the interested parties who believe they have something to contribute.

I think by this technique you will discover that we will be able to get at an agreed-upon statement of facts much more readily than if you take any individual report or any statement just by itself.

We have to look at the whole picture and the conference will give everyone an opportunity to take up every point and discuss it fully.

Both the State and Federal Governments have responsibilities in dealing with water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control pollution. Consistent with this, we are charged by law to encourage the States in these activities.

Opening Statement - Murray Stein

At the same time, the Administrator of the Environmental Protection Agency is charged by law with specific responsibilities in the field of water pollution control in connection with pollution of interestate and navigable waters. The Federal Water Pollution Control Act provides that pollution of interstate or navigable waters, whether the matter causing or contributing to the pollution is discharged directly into such waters, or reaches such waters after discharge into a tributary, which endangers the health or welfare of any persons, shall be subject to abatement.

The October 1965 amendments to the Federal Water Pollution Control Act additionally empower the Administrator to initiate enforcement procedures whenever he finds that substantial economic injury results from the inability to market shellfish or shellfish products in interstate commerce because of the pollution of interstate or navigable waters, and the action of Federal, State, or local authorities.

This conference on pollution of the

navigable waters of Galveston Bay and its tributaries is the sixth to be held under these shellfish provisions of the Act. Of course, as the representatives of the shellfish industry and many others know, we have had one large case in Washington's Puget Sound involving discharges from paper mills and injury to the Pacific oyster industry, but that conference was called on the initiation of the Governor of Washington. The five earlier shellfish-provision conferences involved New York (Long Island), Maine, New Jersey, Massachusetts, and Alabama. The experience we have gained from these five enforcement conferences and from several other interstate and intrastate conferences held through the years has shown us that each area of concern presents its unique features. Many pollutional causes and problems are shared in common from city to city but the particular local geographic and socio-economic factors of the area always form a good part of our consideration.

Today's conference will cover the effects on interstate commerce caused by pollution of the shellfish beds in Galveston Bay. We expect the conference will be useful in providing a clear picture of the problem, delineating the progress which has already been accomplished, and in indicating what needs to be done to correct the pollution problem in these navigable waters.

As specified in Section 10 of the Federal Water Pollution Control Act, the Administrator has notified the official State water pollution control agency, which is the Texas Water Quality Board, of this conference. The Texas Water Quality Board will be represented by Mr. Hugh Yantis.

The Federal conferee is Mr. Richard Vanderhoof.

I am very happy that my boss has come down and is here at the head table with me, Mr. John R. Quarles, Jr., the General Counsel and the Assistant Administrator for Enforcement of the Environmental Protection Agency.

My name is Murray Stein. I am from headquarters of the Environmental Protection Agency in Washington, D. C., and the representative of Administrator Ruckelshaus.

Opening Statement - Murray Stein

The parties to the conference are the official State water pollution control agency and the Environmental Protection Agency. Participation in this conference will be open to representatives and invitees of these Agencies and such persons as inform me that they wish to present statements. However, only the representatives of the State water pollution control agency and the Environmental Protection Agency constitute the conferees.

We are going to follow our usual procedure in allowing the State and the Federal Governments to manage their own time. In other words, Mr. Vanderhoof will call on representatives of Federal Agencies, and Mr. Yantis will call on the constituents in the State agencies in the order that he wishes.

I would suggest that all the people from Texas who wish to make a statement get in touch with Mr. Yantis and make your own arrangements with him for your presentation at an appropriate recess or at a break.

Now a word about the procedures governing the conduct of the conference. The conferees will be called upon to make statements. The conferees, in addition, may call upon participants whom they have invited to the conference to make statements. In addition, we shall call on other interested individuals who wish to present statements. At the conclusion of each statement, the conferees will be given an opportunity to comment or ask questions, and I may ask a question or two myself. This procedure has proven effective in the past in reaching equitable solutions.

At the end of all the statements we shall have a discussion among the conferees and try to arrive at a basis of agreement on the facts of the situation. Then we shall attempt to summarize the conference, giving the conferees, of course, the right to amend or modify the summary.

Under the Federal law, the Administrator is required at the conclusion of the conference to prepare a summary of it which will be sent to the conferees. The summary, according to law, must include the following points:

1. Occurrence of pollution of navigable

waters subject to abatement under the Federal Act;

2. Adequacy of measures taken toward abatement of pollution; and

3. Nature of delays, if any, being encountered in abating the pollution.

Again, let me emphasize what we have to do under the law because I think this is where a good deal of the thrust of the comments I have heard are directed, and I think the law indicates that this is what we have to do. As to Item 1, I think if we exercise due care, we have to carefully determine if there is occurrence of pollution of navigable waters subject to abatement under the Act.

The second item requires us to determine the adequacy of measures being taken toward abatement of pollution. Of course, this will include whatever has been done by industries and municipalities in the past to take corrective action.

And the third is to look into the nature of delays, if any, being encountered in abating the pollution.

The Administrator is also required to make recommendations for remedial action if such recommendations are indicated.

A record and verbatim transcript of the conference is being made by Mrs. Bobbie Ames. This is being made for the purpose of aiding us in preparing a summary and also for providing a complete record of what is said here. It usually takes about 3 or 4 months for the transcript to come out in printed form. If you wish a record beforehand, you can check with the reporter, who is an independent contractor, and make your own arrangements with her.

I would like to point out we do not print the transcript in color. So take that into account. With any charts or visual displays you may have, try not to refer to color in describing them, as the references may well be meaningless in the transcript.

We shall make copies of the summary and transcript available to the Texas Water Quality Board. We have generally found that for the purpose of maintaining relationships within the States, the people who wish summaries and transcripts should request them through their State agency rather than come directly to the Federal Government. The reason for this is that when the conference has been concluded we would prefer people who are interested in the problem to follow the normal relations in dealing with the State rather than the Federal Government. This has worked successfully in the past, and we will be most happy to make this material available for distribution.

I would suggest that all speakers and participants other than the conferees making statements come to the lectern and identify themselves for purposes of the record, before making a statement.

I also would like to indicate that we are going to be here until everyone is heard.

You will be given a chance to state your views fully, and I suggest if we are all patient and work with this situation, we will be able to have a very fruitful conference and develop the facts so we can proceed in whatever way seems appropriate at the conclusion of the conference.

I believe we have Congressman Eckhardt who indicated he wishes to make a statement.

Hon. Bob Eckhardt

Congressman Eckhardt.

THE HONORABLE BOB ECKHARDT
U. S. HOUSE OF REPRESENTATIVES
WASHINGTON, D. C.

MR. ECKHARDT: Thank you, Chairman Stein. Mr. Quarles, glad to see you, sir. Mr. Vanderhoof and Mr. Yantis.

This is a rather appropriate time to speak with respect to the channel area for me, because the Texas Legislature has just redistricted and placed both sides of the channel in my district. (Laughter.)

I had originally had Baytown. Now the district goes on down to LaPorte and includes both sides of the channel.

I must say that I somewhat anticipated this, for while I was in the legislature I had a considerable concern about this body of water for a good number of years, and I might say at the beginning that, of course, the body of water is one that is for the benefit of all persons in Houston, in the Nation, and is one of the great harbor areas of the

United States and of the world.

I have a great interest in clean water and a great interest in the marine life that spawns in it. But also I have concern about the development of the industry along that channel, which is one of the greatest chemical and petrochemical complexes, as you all know, in the world.

First, I want to commend the Environmental Protection Agency for the report on "Pollution Affecting Shellfish Harvesting in Galveston Bay, Texas." It appears to me that EPA has done its homework. I also would like to commend the EPA for calling this pollution enforcement conference under the Shellfish Clause of the Water Quality Act of 1965, while pointing out that it is exactly 4 years later than I had requested it.

In June 1967, in a letter to James Quigley, Commissioner of the Federal Water Pollution Control Administration, I pointed out that serious economic injury to the shellfish industry was being caused by pollution in that some 58 percent of the Galveston Bay Estuary was off limits for oyster production and that our oysters are shipped all over the East, as far as the Eastern Shore of Maryland. You will be interested to know that I received a reply from Mr. Quigley to the effect that the FWPCA had deferred action under this clause in Galveston Bay for two reasons: One reason was that the President's Water Pollution Control Advisory Board was due to come to Texas within the week to see firsthand our pollution problems. Secondly, the State of Texas was scheduled to submit its water quality standards to the FWPCA within a month for approval, and that the Administration wanted Texas to have the first opportunity to solve its own problems.

Gentlemen, those two reasons for deferment on action have come and gone, and so have 4 long years. And our water quality, I maintain, is no better than it was at that time. The President's Board, in 1967, sharply criticized the Houston Ship Channel, charging that, at times, it was one of the worst polluted bodies of water in America. Three and a half years later, the Board returned to Texas and found the conditions to be no better. I maintained that the proof of the oyster is in the eating, and that the State of

Texas has not moved adequately to restore the quality of the waters in the most important estuary on the Texas Gulf Coast and one of the most important on the entire Gulf Coast of the United States. I intend to document my charges.

Mr. Chairman, I realize that the States have primary rights and responsibilities for taking action to abate and control pollution and that a Federal Agency is charged with encouraging States in this activity. But my position is that the State of Texas has failed miserably in this role, and I intend to document this charge in both this paper and another that I will submit as part of my presentation.* And I believe that Federal action is not only required but is absolutely necessary under the Federal Water Pollution Control Act, due to the danger from pollution not only to marine life but to humans as well, who are entitled to use these interstate and navigable waters for their livelihood, their recreation, and their aesthetic enjoyment.

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* See page 58

First, I want to dispel once and for all a myth that State officials have tried to foist upon Federal officials. And that is the myth that waters in the Galveston Bay System have improved and that enlargement of oystering areas and an increase in oyster production are due to water quality improvement. Nothing could be further from the truth.

On Sunday, January 10, 1970, just one day before the President's Water Pollution Control Advisory Board met in Houston, the Texas Water Quality Board met in the Rice Hotel, and a program was presented that purported to show that the quality of Galveston Bay waters had improved since 1959. And to prove this, the board's staff presented testimony that more areas in the bay had been opened up to commercial oystering during the preceding decade. And evidently this farce had the desired effect. For, in its report, the President's Board commented: "Efforts to obtain information on any recent closing of oyster beds due to pollution evoked testimony that approved areas have been expanded." While this was factually true, the reasons that the State gave for opening these areas were false.

Hon. Bob Eckhardt

Let me fill you in on the history of this situation. Actually, the State's shellfish pollution study began in 1936, but it was rather haphazard due to lack of personnel and adequate monitoring equipment. And it was not until 1963 that a real monitoring program and heavy surveillance was begun.

In 1967, after a new area had been opened to commercial oystering by the Texas Department of Health, a member of my staff asked Mr. Dudley Johnson, who is in charge of shellfish sanitation programs in Texas, if opening of this area was due to water improvement. Mr. Johnson emphatically stated that this was not true, that it was simply a matter of Health Department personnel having more time and better equipment to remonitor some of these bay waters and having found them compatible with commercial oyster production.

In other words, when the shellfish sanitation program was first put into effect, the Health Department simply did not have the time, personnel or equipment to personally check every acre of water in Galveston Bay, and where there were areas where they thought there might be some danger from hepatitis or other microorganisms, they arbitrarily placed them off limits. Later, with more time and staff, they remonitored these areas and found that they were in fact clean enough for commercial oyster harvesting.

In early 1970, after Mr. Hugh Yantis had made his rosy report for the benefit of the President's Board, I again had my staff talk to Mr. Johnson, and he reiterated his earlier report to the effect that virtually every acre opened to oystering since the program began was due to better monitoring and increased surveillance. He told Mr. Ozmore of my staff: "Perhaps some of the bay has been opened to oystering because of water quality improvement, but it has been very little." As recently as mid-April of this year, when Ralph Nader released his report on the Houston Ship Channel, I again had Mr. Ozmore talk to Mr. Johnson, and he gave essentially the same report.

Now, to illustrate my position, let us look at a chart of the Galveston Bay Complex. First, let me locate for you the major oyster beds in the bays.

Figure 1 locates the reefs in the Galveston Bay System. (Figure 1 follows.)

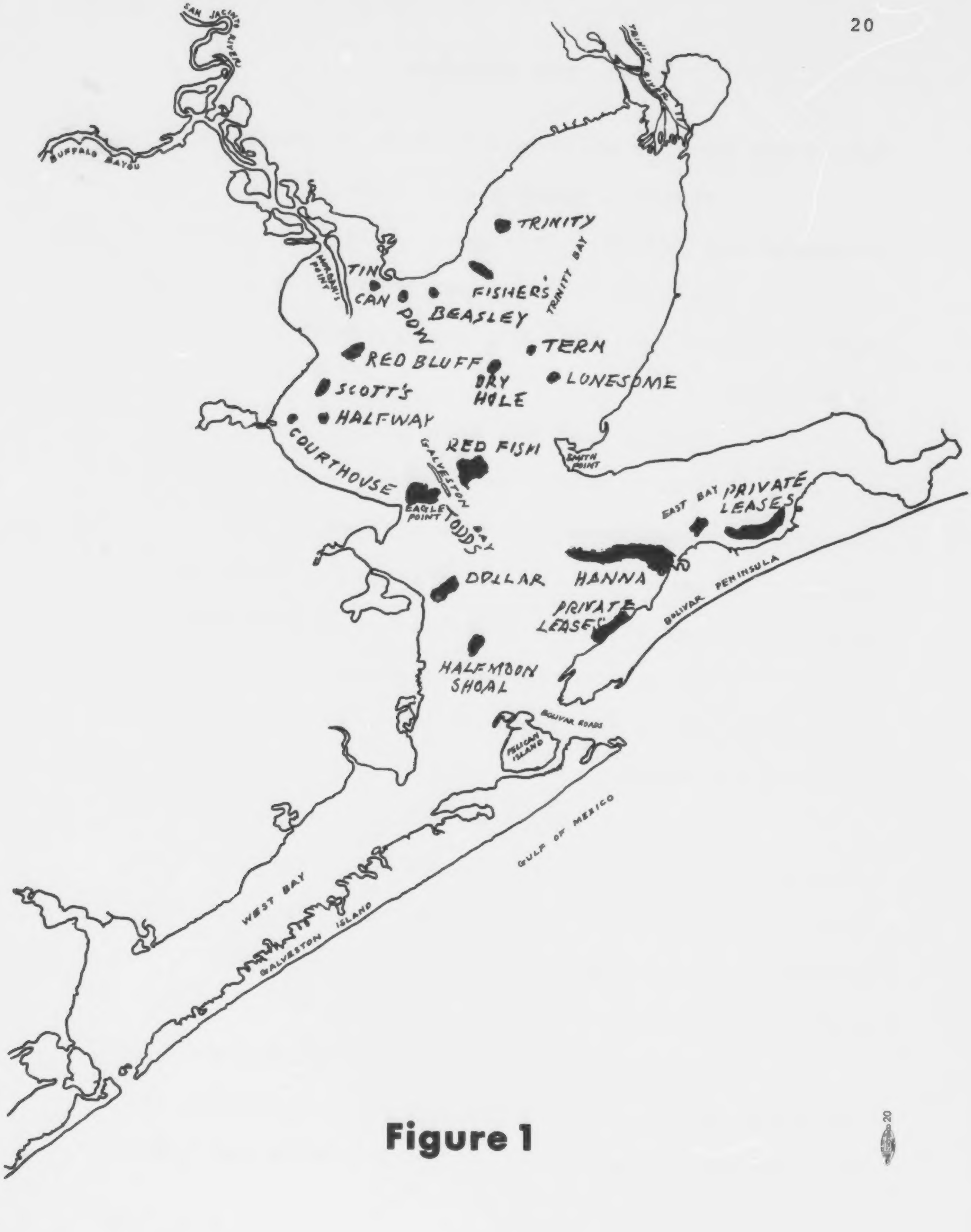
The two biggest reef structures are around what is called Todd Dump and Hanna's Reef in this area (indicating).

Dollar Reef has been called a dead reef. It isn't precisely dead. As I know you all know with respect to these reefs, various changes in the salinity of water may make some reefs at times very productive, and at other times rather unproductive.

So, it is always important to continue to protect all of the reefs to the best extent that can be accomplished.

I might add here too, of course there are several things that hurt oyster reefs. Some of them hurt them for eating purposes as, for instance, this is particularly true of sewage, but they don't necessarily hurt the growth of oysters.

Other chemical pollutants may be a permanent danger to oysters, and also of course, the destruction of the reefs, obviously, would put them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BUFFALO BAYOU
TRINITY RIVER
TRINITY
MORGAN'S POINT
TIN
CAN
POW
FISHER'S
BEASLEY
TRINITY BAY
TERM
RED BLUFF
DRY HOLE
LONESOME
SCOTT'S
HALFWAY
COURTHOUSE
GALVESTON BAY
RED FISH
SMITH POINT
EAGLE POINT
TODD'S
EAST BAY
PRIVATE LEASES
HANNA
DOLLAR
PRIVATE LEASES
BOLIVAR PENINSULA
HALFMOON SHOAL
BOLIVAR ROADS
PELICAN ISLAND
GULF OF MEXICO
WEST BAY
GALVESTON ISLAND

Figure 1

out of production.

So, the reefs as shown there are the producing reefs in Texas, some of them large and some small. And I am sure that some of those that we have there have probably been removed by dredging in the meantime. [See Figure 1.]

This map is not altogether up to date and never can be with respect to this proposition. Though that has been stabilized, as you know.

Now, in this figure you will see the open areas shaded in black horizontal stripes for the years 1951-1953. [See Figure 2.]

It is an area denoted by the letter "A."

We have marked the areas that are in production, so the areas that are not marked at all are banned for oyster production.

This would all be banned (indicating). A great amount of flow comes out of the Trinity River into this area and creates a considerable amount of pollution from pasturage and from manure and various pesticides, etc.

From the Houston Ship Channel, there is

considerable pollution coming into this area, and, of course, the channel goes out through Bolivar Roads in that direction.

Incidentally, this is one of the most productive areas of the entire Galveston Bay System, the Todd Dump area, and formerly there was a strip across here called Redfish Bar that was productive all the way across.

As a matter of fact, the water is shallow enough so that persons now living can remember when cattle were driven from Eagle Point to Smith Point across the bay (indicating).

This is a heavy producing area.

Besides that, there are a great number of persons who use this area for sports fishing. Any good Sunday you can see a veritable flotilla of boats in that area (indicating).

You will note that most of East Bay is open including the large and productive Hanna's Reef area, the big reef down there close to Bolivar Peninsula and that a small part of the bay southwest of the channel just off of Eagle Point is open.

Hon. Bob Eckhardt

Eagle Point is the place that comes closest to Smith Point over on the other side in Chambers County (indicating).

(Figure 2 follows.)

This is for the years 1955-1957 (indicating). [See Figure 2.]

You notice the first was 1951 to 1953; this is for 1955 to 1957 and indicates that a considerable area has been opened up to oystering denoted by the letter "B" going on up into Trinity Bay including an area southwest of the Ship Channel. (indicated by the wave-like shading.)

Now, here let me make a point to rebut the State's position. Opening of this area came when the State of Texas was doing absolutely nothing to control water pollution. The so-called water pollution control program was operating at that time under what I have called a "possum quarding the chicken coop" theory of water pollution control when 4 members of the board were, by law, required to be representatives of industry and the other 3 were governmental agencies.

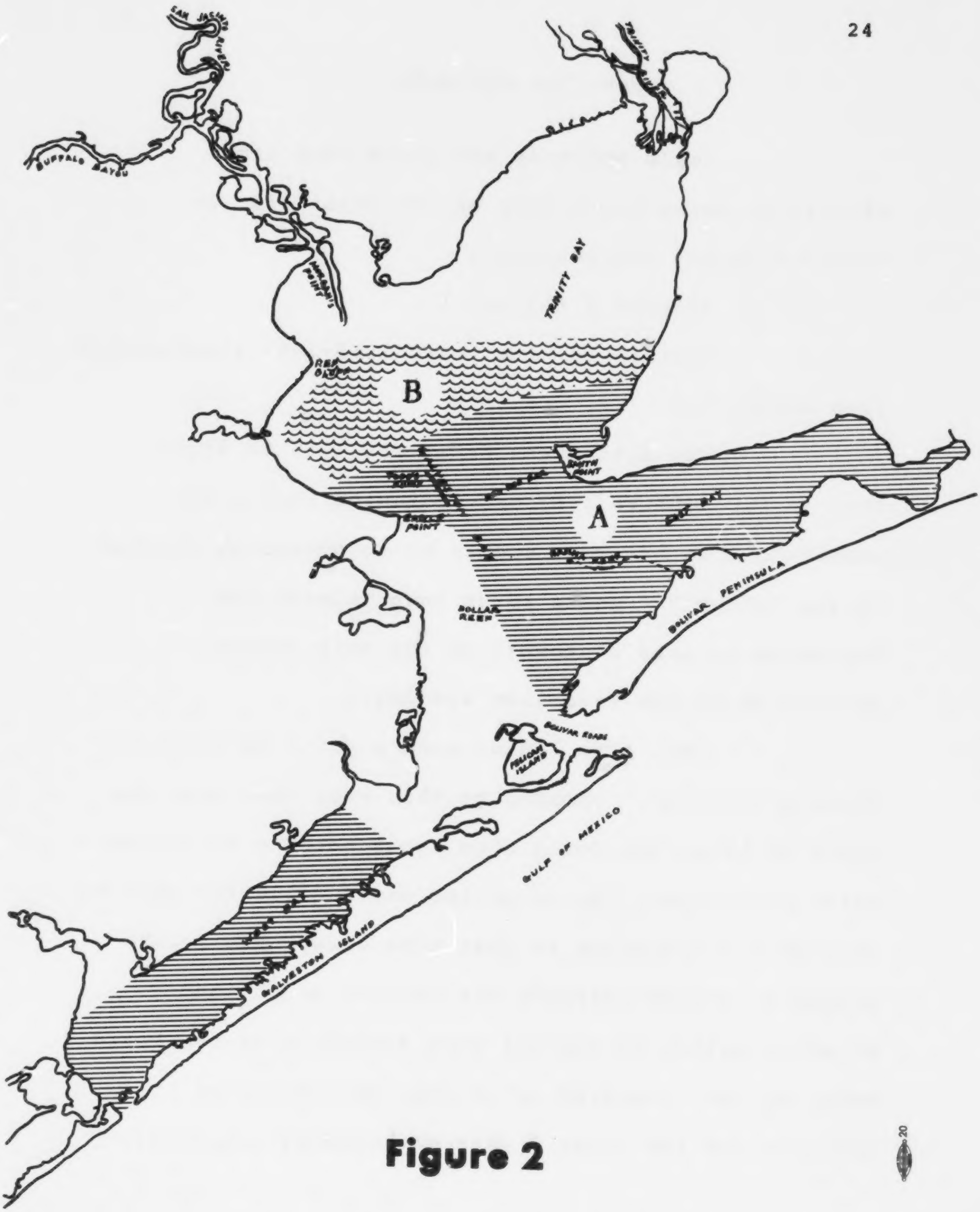

SAN JACINTO RIVER
BUFFALO BAYOU
TRINITY RIVER
MORGAN'S POINT
TRINITY BAY
RED BLUFF
B
SMITH POINT
EAGLE POINT
A
EAST BAY
DOLLAR REEF
BOLIVAR PENINSULA
BOLIVAR ROADS
PELICAN ISLAND
GULF OF MEXICO
WEST BAY
GALVESTON ISLAND

Figure 2

No efforts whatsoever were made to make industries or municipalities conform to adequate standards or to upgrade their effluents.

But it was during this same period that Harris County's pollution fighter, Dr. Walter Quebedeaux, was having some success making polluters toe the line.

From 1955 to 1961, Dr. Quebedeaux was able to haul industrial polluters into court, until a court of civil appeals ruled a corporation could not be prosecuted for violation of air and water pollution laws. It was on February 22, 1955, that Dr. Quebedeaux filed this rather glowing report.

He said, "We had been in operation a little over a year and had been able to convince the plants that the place to control pollution was at the point of discharge and by getting some of these discharges cleaned up, it had made a big difference in the channel. We were able to see, at that time, schools of small top-water minnows up and down the channel. The algae were growing in the channel, and Nature was recovering from the battle she had been having with unrestricted discharge in the past."

Dr. Quebedeaux further reported that, through the whole length of the Ship Channel, there was only about 1 mile where marine life could not exist and that was about half a mile on each side of Hess Terminal properties.

I also would call to your attention, Mr. Chariman, that it was during this same period that the United States Department of Justice had been moving under the Refuse Act of 1899 to control pollution, and it actually prosecuted several polluters, but this progress was not to last.

Under the administration of President Eisenhower, the Justice Department was ordered to stop bringing pollution suits.

No, gentlemen, this improvement in the Ship Channel waters and the increase in oystering area were not because of the Texas Water Pollution Control Board, but in spite of it.

Now, let's look at the next figure. (Figure 3.)

[Figure 3 follows.]

This represents the bay system from

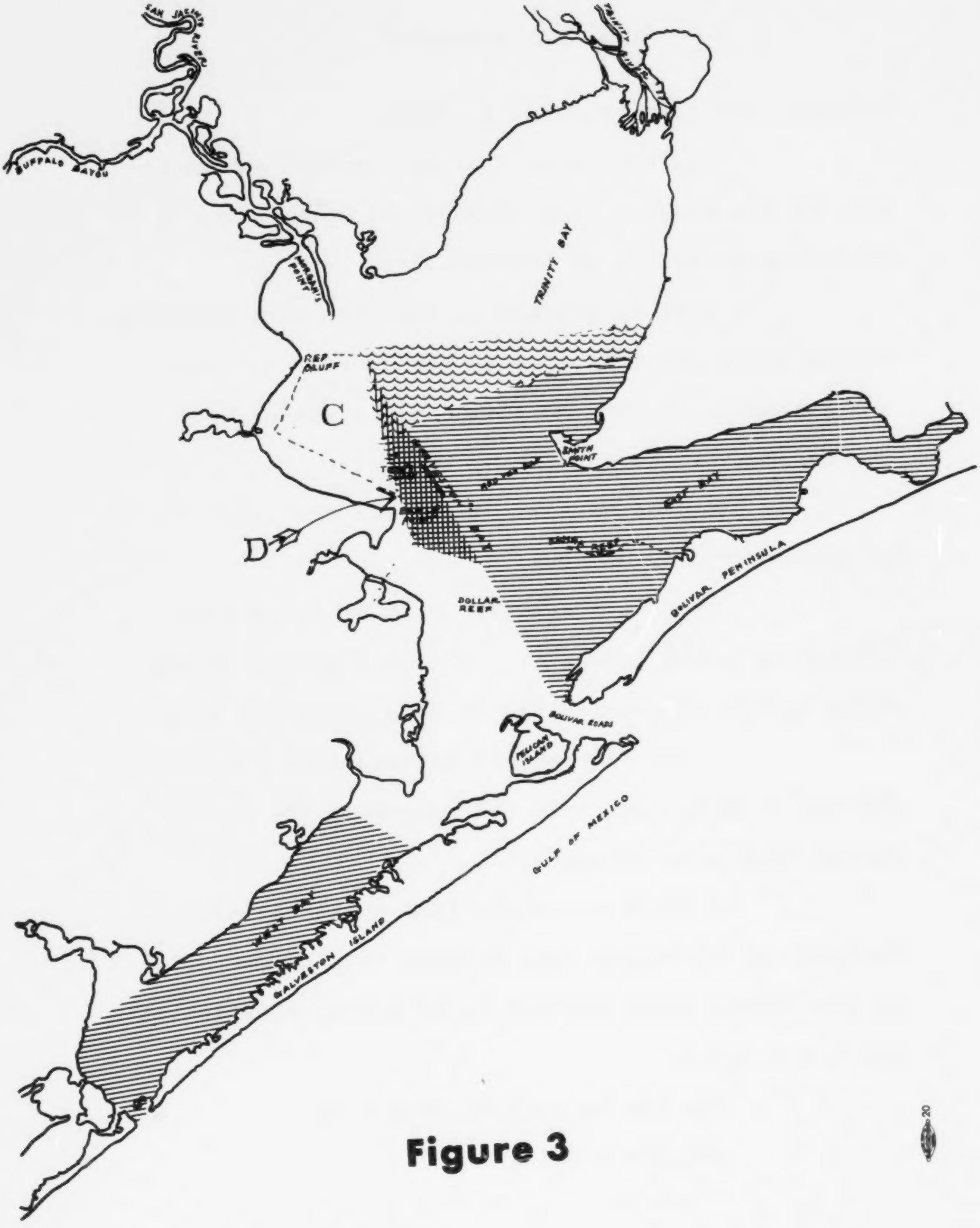

SAN JACINTO RIVER
TRINITY RIVER
BUFFALO BAYOU
MORGAN'S POINT
TRINITY BAY
RED BLUFF
C
SMITH POINT
RED FISH BAR
EAST BAY
D
DOLLAR REEF
BOLIVAR PENINSULA
BOLIVAR ROADS
PELICAN ISLAND
GULF OF MEXICO
WEST BAY
GALVESTON ISLAND

Figure 3

October 1958 through July, 1, 1965.

You will note that all of the bay southwest of the Houston Ship Channel was closed to oystering effective in October 1958.

This is denoted by the area surrounded by dotted lines and indicated by the letter "C," with the exception of the odd-shaped piece shaded with cross-hatching and denoted by the letter "D."

Incidentally, that covers the very productive Todd Dump area.

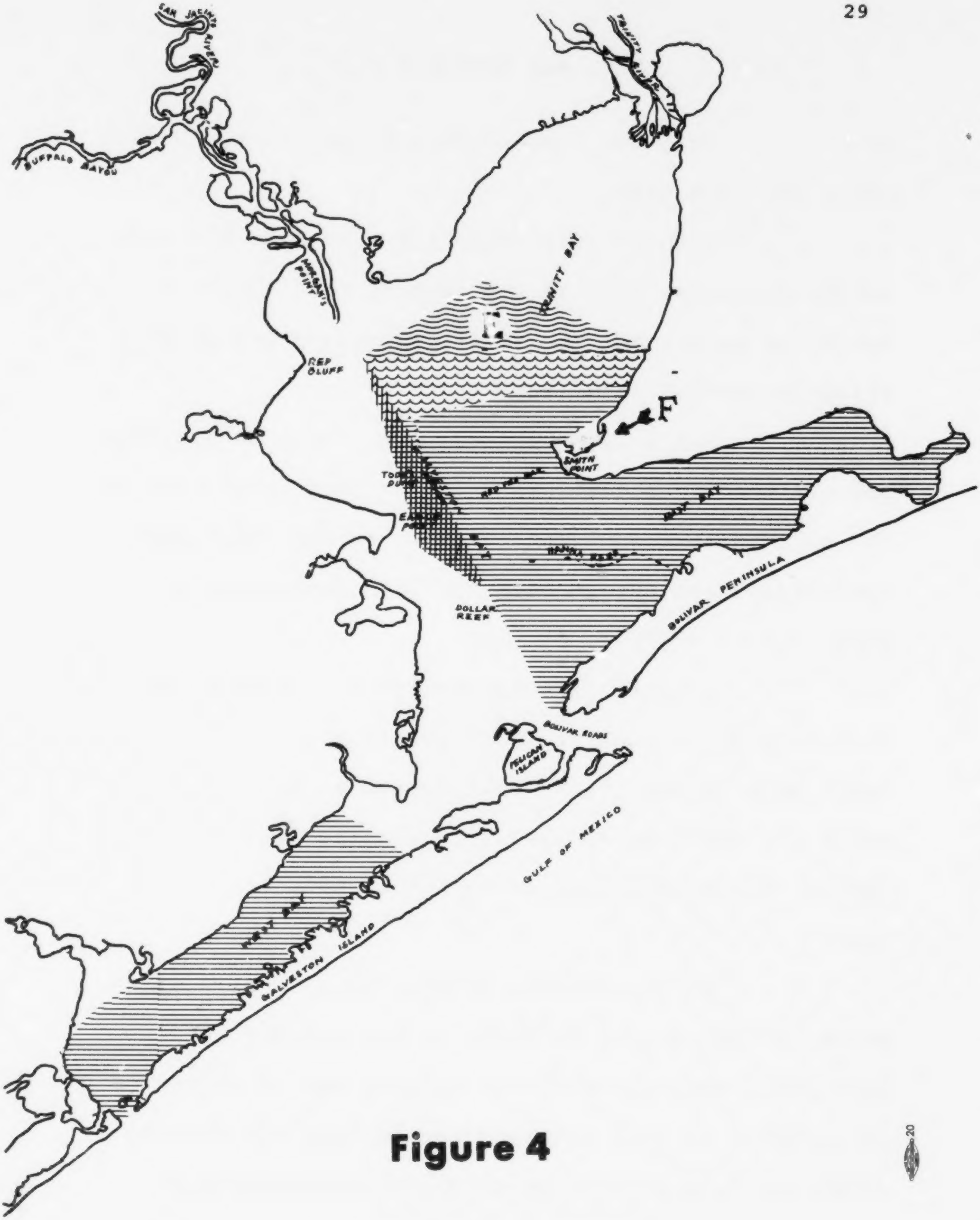
This is a conditionally approved area subject to being closed on a moment's notice if the State Health Department should find potential danger.

So we lost ground between 1955 and 1958 and not 1 additional acre was opened in the 7-year period from 1958 through 1965.

I think you would find that pollution control had virtually been brought to a complete halt at the county level and had never gotten airborne at the State level.

Now let us turn to Figure 4.

[Figure 4 follows.]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HANNA REEF
DOLLAR REEF
BOLIVAR PENINSULA
BOLIVAR ROADS
PELICAN ISLAND
GULF OF MEXICO
WEST BAY
GALVESTON ISLAND

Figure 4

This one represents the bay for the years 1966, 1967 and 1968.

Here you will find the situation the same on the southwest side of the channel, all closed to oystering except for the area I mentioned previously which is conditionally approved.

But a comparatively small area of Trinity Bay has been opened to oystering denoted by the letter "E" at the top there (indicating), though this chart indicates there are no reefs of any consequence in this newly opened area.

I would like to discuss this body of water in detail for a moment. But first let me point out a small area in the "fish hook" formed by Smith Point which has now been declared off limits, denoted by the letter "F," a harbinger of things to come for this area.

At the meeting of the Texas Water Quality Board on that Sunday in 1970, it was brought out forcefully that pollution of Trinity Bay is caused principally by soil bacteria washed down the Trinity River and from the pastures, swamps and marshlands surrounding that body of water.

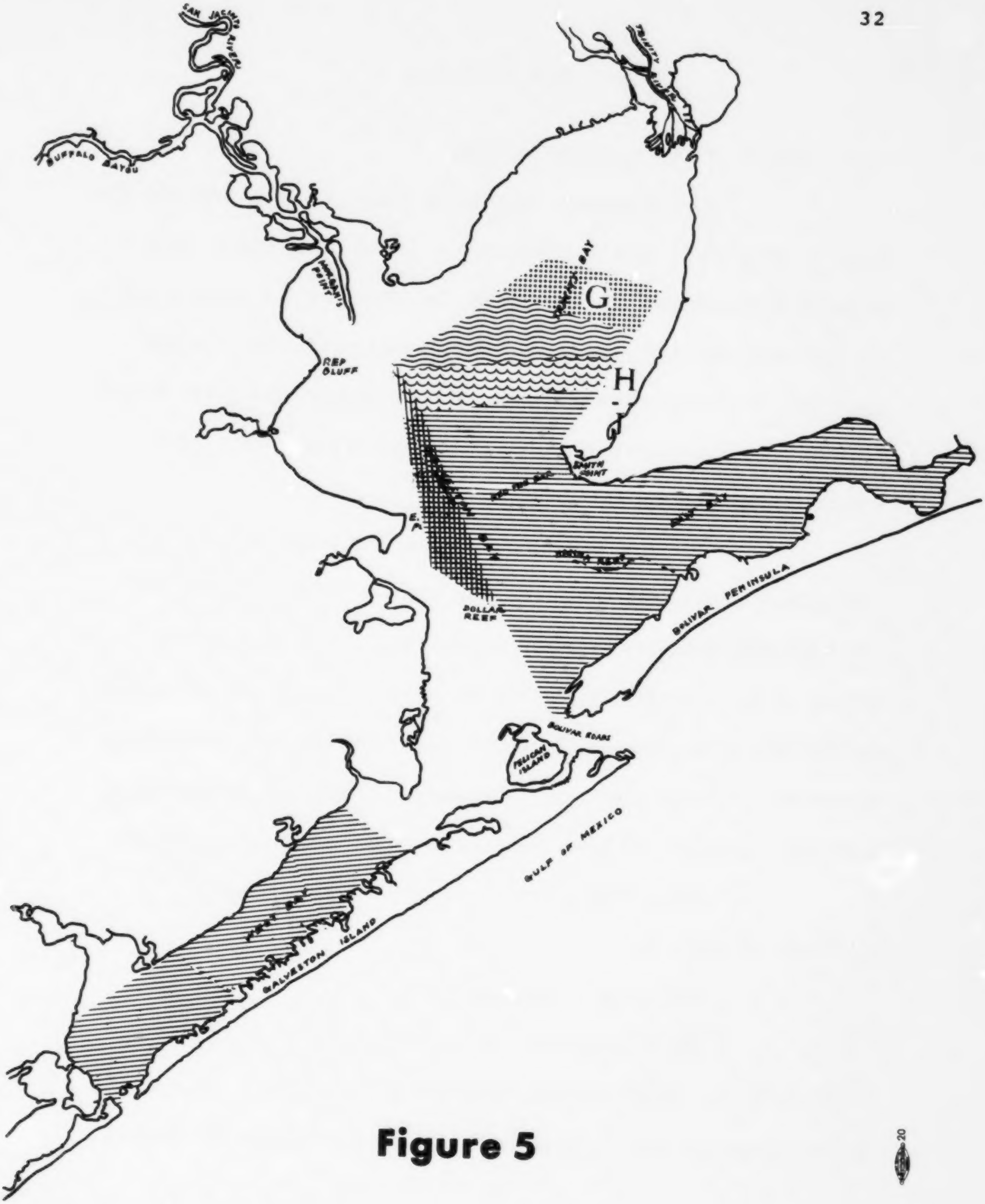
Mr. Johnson confirms this as did the President's Board in its report. So, when the State Health Department opened up the area in Trinity to oystering, it was not because of any improvements in the water quality brought about by the Texas Water Quality Board, for that agency has no control whatsoever over what enters that bay.

It was opened for one of 2 reasons: 1) The Health Department had the time and personnel for accurately monitoring the area, and 2) The water quality had actually improved somewhat due to changing conditions in the land areas surrounding it, possibly because of improved human sewage treatment facilities, such as indoor toilets replacing the outdoor privies.

Now, for a look at the last of this series, Figure 5.

[Figure 5 follows.]

This presents the area open for oystering from July 1, 1969, until September 1, 1970. It is the latest report available from the Department of Health.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E. P.
DOLLAR REEF
BOLIVAR PENINSULA
BOLIVAR ROADS
PELICAN ISLAND
GULF OF MEXICO
WEST BAY
GALVESTON ISLAND

Figure 5

You will note that the open area has been extended further into Trinity Bay. That is denoted by the letter "G," but I hope you will also note an expanded area along the northwest shore of Smith Point Peninsula has been closed down and is denoted by the letter "H."

If you will note, that is an area where there is no oystering production in some reefs.

Here I want to take exception to some figures in the EPA report provided by the Texas Parks and Wildlife Department.

This report indicates that in 1969, there were some 9,100 acres of oyster beds open to oystering, an increase of 200 acres over the previous year.

Yet, I would point out that the opened area extending into Trinity Bay at this point contains no oyster reefs whatsoever, yet the newly-closed area along the northwestern shore of the Smith Point Peninsula contains somewhat between 250 and 300 acres of producing oyster reefs, according to Mr. Ben Nelson of the Nelson oystering concern which has been oyster fishing in this bay for half a century.

Not only is this area along Smith Point practically as large as the newly-opened area but it contains producing oyster reefs. I do not believe that removal of these 250 acres has been taken into consideration in the EPA report, and this means the area actually open to oyster proudction as of this date amounts to only 8,850 acres, an increase of only 50 paltry acres over the total amount open in 1955.

Is this what the Texas Water Quality Board refers to as being a dramatic increase in oyster production areas due to water quality improvement?

If these figures by the Texas Parks and Wildlife Department are accurate -- and I seriously doubt their accuracy -- then it means there were only 300 more acres of reefs in approved areas in 1969 than there were in 1955. And I believe that testimony by Mr. Johnson will bear out my position that this is due to better monitoring and stronger surveillance rather than to water quality improvement.

Now, Mr. Chairman, let me briefly summarize the information included in this display. The areas left uncolored are those areas which are off limits to oyster production, and the shaded areas are those areas open to oyster production.

Now, while I am at it, I would like to shoot down another balloon lofted by the State which is an argument that is even more fallacious than the preceding one. That argument is that increases in oyster production are evidence of water quality improvement.

Let us look at the oyster production for consecutive years on this chart. (See Figure 6.)

[Figure 6 follows.]

In 1955, oyster production in this complex amounted to 543,000 pounds taken from 8,800 acres of oyster beds.

Remember, this was the year that Dr. Quebedeaux reported the Ship Channel in fairly good condition.

Would it not seem logical the water quality in the bay was better than in earlier and subsequent years when the water quality declined in the Ship Channel?

Now in 1956, production climbed to

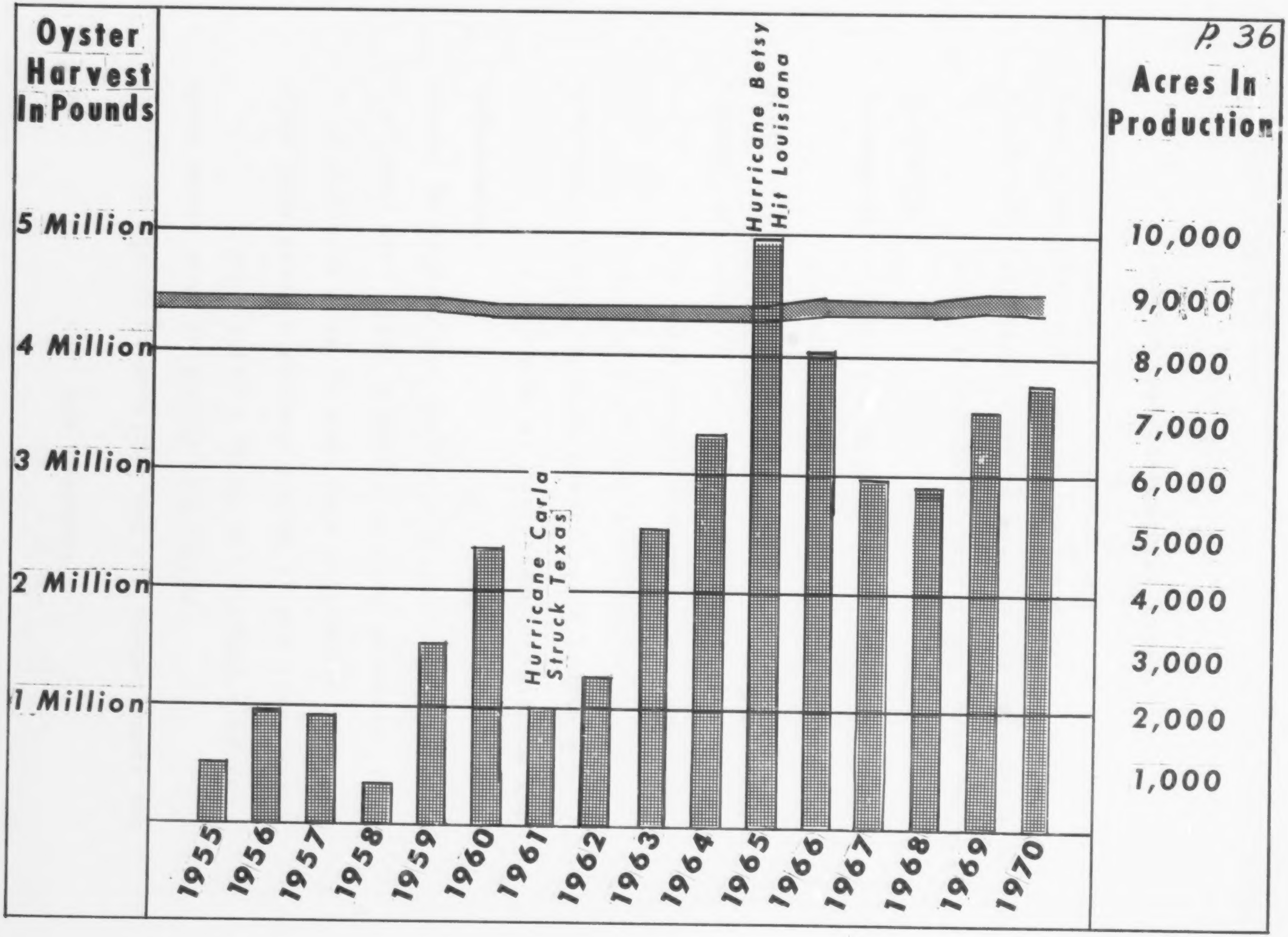
Oyster Harvest In Pounds
5 Million
4 Million
3 Million
2 Million
1 Million
Acres In Production
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
Hurricane Carla Struck Texas
Hurricane Betsy Hit Louisiana
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970

Figure 6

986,000 pounds, and then dropped to 953,000 pounds in 1957. If water quality improvement affects oyster production, then why this drop when this period indicates that the water quality probably had improved, due to forceful actions by the Harris County Pollution Control officer?

Gentlemen, there are many factors that affect oyster production. It fluctuates greatly for reasons far different than questions of water quality. One thing is changes in salinity; a difference in the amount of rainfall; the nature of the predators on oysters. Sometimes we don't know why these changes occur.

In 1958, production slumped to a long-time low for the years when records were kept, just 311,000 pounds. This was the year you recall that substantial areas of oystering were closed down west of the Houston Ship Channel and in the far East Bay. It might be logical to assume closing down of these areas slashed oyster production.

Let me pursue that further. In the following year, 1959, exactly the same areas were opened to oystering, yet production more than quadrupled to 1,411,000, and to a record all-time high in 1960 to 2,296,000 pounds.

Yet in 1960 exactly the same area was open to oystering as in 1958, when only 311,000 pounds were produced.

Does this bear out the argument that water quality improvement has brought about an increase in oyster proudction?

Let us look further.

In 1961, there were 1,096,000 pounds of oyster meats produced. In 1962, 1,211,000 pounds. In 1963, 2,618,000 pounds. In 1964, 3,357,000, and in 1965, another record of 4,836,000 pounds. Yet, Mr. Chairman, in that year there was not 1 acre more open to oystering than there was in 1958 with its puny 311,000 pounds.

Let us look further.

In 1966, a new area was opened to oystering and this situation existed through 1968. Yet, oyster meat production dropped to 4,083,000 pounds in 1966; 2,993,000 pounds in 1967 and 2,839,000 pounds in 1968.

In 1969, oyster production began to climb again rising to 3,447,000 pounds, but I do not believe that anyone can logically claim this increase was due to opening of more areas, particularly since the area opened in Trinity Bay has few oyster reefs, while the area closed down along the Smith Point shore does contain considerable oyster reefs, at least 250 acres.

If the State's argument that the water quality improvement has brought about opening of more oyster reefs and thereby producing more oyster meats, I will argue with them. Why then does oyster production go up and down like a yo-yo, while water quality in the areas opened to oyster production have remained relatively stable?

One might ask why has oyster production fluctuated so radically? Basically the thing that determines oyster harvesting is the number of oyster boats participating in the harvest. Sometimes nature does have a hand in it.

It was in September 1961 that Hurricane Carla, one of the most vicious hurricanes ever to hit the North American coast, swept ashore at Port

O'Connor, dumping torrential rains upon the coast from Corpus Christi to Beaumont and Port Arthur. Our oyster beds were decimated, and the oyster fishermen quit oystering or moved into Louisiana causing the production to drop in 1961 and 1962.

By 1963 the beds had recuperated and oyster production rose again.

In 1965, another hurricane brought about a change in oyster production in Texas -- this time a tremendous increase. It was in September of that year that Hurricane Betsy went ashore in Louisiana, devastating that State's oyster beds. As a result, Louisiana fishermen swarmed to Texas waters, increasing the number of oyster boats working the area, thus sharply increasing the size of the harvest. Another factor affecting the size of the harvest is that the Texas Game and Fish Commission on August 1, 1963, reduced the legal size of the oyster from 3-1/2 inches to 3 inches, thus resulting in the keeping of more oysters by the fishermen.

Now let us turn for a few moments to another program which has been subject to controversy --

the Galveston Bay Study. When Colonel Frank Bender, Project Director for this study, explained it to me in mid-1967, I told him that while I did not object to studies, per se, I did not think that enforcement of pollution abatement should be held back to await results of the study. It has been our experience in Texas that studies have been used for one major purpose -- that of delaying action. While I realized that Colonel Bender had no authority in the enforcement field, I was given the impression that the State was going to move forward with enforcement while the study was going on. This has not been done, and I am extremely disappointed.

It has seemed to us that study has been layered upon study, and that each one takes so long that State agencies, upon completion of a study, take the position that so much time has passed it must make another study to see if the facts of the first study still hold up. You can see that this would delay action infinitely.

From its inception, the Galveston Bay Study has cost the State $1,401,000 and the Federal

Government an additional $565,000, making a total of $1,966,000. Now this is quite a large sum of money to spend on a study, with not a cent being expended upon monitoring outfalls from polluters or for enforcement of effluent standards. I have been told that a Federal official has consistently insisted that an intensive waste source survey be included as a part of the Galveston Bay Study, but that the Executive Director of the Texas Water Quality Board has fought just as hard against such a survey, maintaining that it would be too costly -- about $550,000. It seems to me that the value of such a survey to find out what each industry along the Ship Channel is contributing to the pollution would have been well worth this amount of money.

In my discussion with Colonel Bender, I maintained that the proof of the pudding was in the eating, and that we would obtain cleaner water when, and only when, polluters are required to install pollution control equipment that will emit a better quality effluent.

One of the criticisms that I have had of the study is that those in charge have failed to develop a staff with the expertise needed, and have had to rely upon contracts with engineering firms. In fact, it seems to me that the study probably has been more of a windfall to firms such as Bernard Johnson, Turner, Collie and Braden and Tractor, Inc., than it has been of help in pollution abatement.

Now we are told that it will be a minimum of 2 more years before this study is completed at a cost of about $3 million. It would seem advisable to me to begin putting this money into a program to monitor discharges by industrial polluters and to hire an enforcement staff to see that effluent standards are maintained. I would like to point out that no one at the State level became concerned about the danger of discharges of mercury and other heavy metals until about a year ago. It seems to me that, had we had this intensive waste source survey in effect since 1967, the Texas Water Quality Board could have had that information available many months ago, and could have required the polluters to halt such discharges.

Hon. Bob Eckhardt

The Texas Water Quality Board and its officials do deserve credit for their recent action in moving to implement State funding under the Clean Water Restoration Act of 1966, even though it comes somewhat belatedly. But it's better late than never, and I realize that it may not have been due to foot-dragging by the Water Quality Board.

I have served in the Texas Legislature, and I know who holds the purse strings. And I know that the chairman of the House Appropriations Committee has refused to approve funds for environmental purposes, and possibly this is why the State has not moved before now.

There have been two actions by the State within the past few months that are most commendable. First, the Water Quality Board has been most cooperative in working with my office and the Environmental Protection Agency in developing a program whereby municipalities and WCD's in Texas would not lose an estimated $50 million in Federal funds under the Clean Water Restoration Act. I began to work on this proposition about 18 months ago, and it was just within the last few weeks that we were able to finally work out the details whereby the River Basin Authorities would provide the State's share of funds for sewage treatment facilities, thus insuring that 55 percent Federal funding would be available, as compared with 30 to 33 percent if the State provided no funds. I have been assured by Mr. Jack Davis, Executive Director of the Gulf Coast Waste Disposal Authority, that this $50 million will be utilized by the June 30 deadline.

The second action the State has taken is that of providing $100 million in bonds to fund this program for the next 2 fiscal years. Texans went to the polls on May 18 and approved this constitutional amendment by a scant 50,000 votes. This assures municipalities of the State's share of funding and means the cities, towns and water districts will receive, during the next 2 years, a total of $220,000,000 in Federal funds, as compared with an amount ranging from $120,000,000 to $134,000,000.

Since the EPA report indictes that

municipalities are responsible for only about 28 percent of the waste flow into the Ship Channel, these two actions are giant steps toward pollution abatement. With these funds, and an ever-growing move to require consolidation of sewage treatment plants into more efficient larger ones, it seems to me that we may be able to make some real progress on municipal pollution during the next 2 years.

Now, Mr. Chairman, I would like to talk for a few moments about the present damage to the oyster fishery and the potential damage. The actual damage to the fishery through pollution is rather inconsequential, as the EPA report notes. If Mr. Robert Singleton's estimate that some 500 acres of oyster reefs which are potential producers are included in the off limit area is correct, then the boatside economic loss is only about $86,000 or quadruple that for its ultimate value, and we have a loss of $344,000. But there are much more serious consequences possible. Suppose, for instance, all of the Galveston Bay Estuary should be closed to commercial oystering. In 1970, these bays produced 3,850,000 pounds of oyster meats, worth

$1,700,547 at boatside, or more than $6,802,000 by the time they reached dinner tables of Americans. You can see that this in itself would be a disaster to the commercial fisherman on the upper Texas Gulf Coast.

There is yet another aspect. Your report indicates there may be a recommendation made that all of the Galveston Bay Complex be closed to all commercial fishing until it has been ascertained that the marine species taken from the bays are suitable for human consumption. Should such action be taken, let us take a look at two other fisheries which last year were worth at least $500,000 more at boatside than the oyster fishery. I speak of the blue crab fishery and the shrimp fishery.

In 1970, the National Marine Fisheries Service of the National Oceanic and Atmospheric Agency reports that 2,622,000 pounds of blue crab meat worth $244,798 at boatside were caught in these bays. And 1,556,000 pounds of brown and pink shrimp and 4,069,500 pounds of white shrimp were taken in the same bodies of water. These shrimp were worth $1,974,357 at boatside.

Assuming that these species are worth 4 times their landed value by the time they are processed, retailed and served at restaurants, these two fisheries would be worth $8,874,620. Add this total to that of the oyster industry which is facing destruction, and you have a total economic worth of $15,876,620 annually which would be lost should this complex be closed completely to all commercial fishing. Based on the figures in the EPA report, which assume a 5 percent rate of return on this renewable resource, commercial fishing represents to the Galveston Bay area a $317,532,400 capital investment, based on 1970 figures, which has been endangered due to pollution from municipal and industrial wastes. And you must remember that I have not discussed other valuable considerations, such as the aesthetic value of clean water and the losses merchants would sustain because of the curtailment of the use of these waters by sportsmen and vacationers because of the danger they might face from consuming fish taken from these waters.

At this point, before I get into my

recommendations, I want to express my deep concern about a report from the industry-sponsored closed television program just 2 weeks ago. Newspaper accounts indicate that Federal officials say they have decided to take a "soft touch" approach toward pollution control by industry. Mr. Chairman, the "soft touch" approach is not going to get the job done, as we have witnessed such a "soft touch" approach in Texas since 1952, and that is why we are faced with this problem at this pollution enforcement conference today.

As I have shown, the "soft touch" for one industry may result in the "hard line" for another. We environmentalists have been buoyed in recent months by the militant position taken by Administrator William D. Ruckelshaus. But now we are wondering, will the same thing happen to Mr. Ruckelshaus that happened to Interior Secretary Walter Hickel and his assistant secretary, Dr. Leslie Glasgow? Is this National Association of Manufacturers Conference to be the clue to a program of appeasement for big business? If this be true, then again we are up the polluted Houston Ship

Channel without a paddle. (Laughter.)

It is absolutely necessary that the Environmental Protection Agency, the Army Corps of Engineers, and the Department of Justice move quickly and efficiently to bring about a reduction of the pollutants flowing into the Ship Channel.

Now let me turn for a few moments to some recommendations. The recommendations of the report are good, as far as they go. But perhaps they do not go far enough.

First, let me make it perfectly clear that I would be the last person to insist that a bay be kept open to fishing if there is anv possible chance whatsoever that even one person might contact infectious hepatitis or some other dreaded disease from eating its products.

Let me remind you that when you start talking about closing this bay to oystering and to other commercial fishing, you are preparing to put a lot of little men out of business. Most of these industries are family-type small businesses. Few of them gross more than $20,000 annually. There are none here to compare with the Goliaths along the Ship Channel, such as Rohm & Haas, Diamond Shamrock, Armco Steel or U. S. Plywood.

It is grossly unfair to say to the little man, "You must close down your business," while at the same time permitting giant corporations to continue to dump their hydrocarbons, their mercury, lead, arsenic, cyanide, zinc, and chromium into these waters that belong to every citizen of Texas -- not just the corporations.

I say to you that if the little businessman is prohibited from earning his livelihood because big industry has destroyed the quality of these public waters then big industry should in some way be made to bear the brunt of it, either by not being permitted to continue to wastefully use these waters to make millions of dollars for its officers and stockholders or by being made to pay reparations to the fishermen. Is this a drastic and far-reaching recommendation? Well, there has come a time for drastic action.

Further, if this bay is closed to oystering and/or harvesting of all marine species, there is very likely grounds for private legal action in the nature of a class action suit, which possibly would run in the millions of dollars, since one segment of industry has been responsible for the destruction of the livelihood of another in violation of the 1899 Refuse Act.

No agency should play politics with the environmental issue. We in government are sometimes tempted to threaten drastic action on scanty evidence. And I think to talk about closing down the whole bay for taking seafood is not called for. There is absolutely no evidence that the Texas Department of Health has not done a careful and conscientious job. It has placed portions of this bay off limits when this is needed. It has monitored health conditions throughout the State. No case of hepatitis has ever been traced to seafood.

But your agency should be firm along lines of paragraph 3 of the EPA recommendations. These insist upon adequate treatment of municipal sewage. With passage of the $100 million bond issue to provide the State's 25 percent of sewage treatment funding, I am convinced that this program will move forward and that cities and water districts will continuously move toward reduction of the 28 percent waste load which they are now dumping in the Houston Ship Channel.

In this connection, the so-called "zoning" plan for the Houston Ship Channel adopted by the industry-dominated Texas Water Pollution Control Board in 1964, and still supported by the present Water Quality Board is farcical. On June 10, 1964, the Port Commission urged that the channel from Morgan's Point to the Turning Basin be zoned as industrial water -- not for recreation or for marine life production. And the Houston Chamber of Commerce joined the Port Commission in contending that the primary best use for the Ship Channel and its tributaries were for commerce and industry. On October 29, 1964, the Board announced its zoning concept. The Upper Ship Channel area from the San Jacinto Monument to Morgan's Point would be a buffer zone, and from Morgan's Point out into the bay would be classified as a recreational area. When Texas submitted its water quality standards in compliance with the Water Quality Act of 1965, this zoning plan was adopted as part and parcel of those standards.

There is just one thing wrong with this concept. How do you keep industrial effluent from flowing from Zone A, down through Zone B and into Zone C? And how do you maintain Zone C for recreation and marine life production when you cannot keep the pollution from Zone A from contaminating it?

The Houston Ship Channel is not a babbling brook which purifies itself as it flows down to the bay. Permits to pollute have been continually issued by the Texas Water Quality Board on the zoning basis, as if the effluent from those industries were purified in their course or were barricaded from the open bay. I maintain that the waters of Galveston Bay can never be brought up to an acceptable standard if this zoning concept is retained.

Furthermore, let me emphasize another point. The area between the San Jacinto River and Morgan's Point, the so-called "buffer zone," at one time was one of the most important areas in the estuarine zone of the Galveston Bay Complex. The San Jacinto River, Old River, Burnett Bay, Crystal Bay, Scott Bay, Peggy Lake, San Jacinto Bay, Black Duck Bay and Tabb's Bay all were important nursery grounds for two of Texas' most important fisheries -- the shrimp and menhaden fisheries. Now these areas are nothing more than a settling basin for the effluent from the municipalities and the industries along the Ship Channel.

If you do not believe it, Mr. Chairman, I would like to invite you back to Texas about 2 days after torrential rains have flushed the commode that is the Houston Ship Channel and these pollutants have depleted the oxygen in these areas and a fish kill of millions of fish is the result. Not only has this destroyed this extremely valuable estuarine area, but it has destroved the value of hundreds of bay-front homes because of the dangers of living on a polluted body of water and the nauseous odors from the dead marine life.

I would recommend that this zoning

proposition be abolished and that water quality standards be adopted that will bring the water quality in the channel to a point that will bring all of Galveston Bay some day to an acceptable level of cleanliness. In this respect, I urge that new and stricter water quality standards be required for all interstate and navigable waters. And to achieve it, it will be necessary that the Environmental Protection Agency, with the acquiescence of the Texas Water Quality Board or without it, set strict and meaningful effluent standards for all polluters, municipal and industrial.

Finally, I concur fully with Recommendation No. 4 in the EPA report -- that an intensive waste source survey be immediately put into effect at every Houston Ship Channel industry. And as soon as it is known what pollutants each industry is contributing to the channel, that industry be ordered to cease and desist from further discharge until the effluent is cleaned up.

Mr. Chairman, as documentation of the history of the polluters of the Galveston Bay area, I would like to submit, for the record, a copy of a paper which I have written and which will be published in mid-summer by the Texas International Law Journal at the University of Texas. It is entitled "How We Got the Dirtiest Stream in America" and is a history of pollution control -- or the lack of pollution control -- in Harris County dating from 1952 until the present.

And, in closing, I want to comment on a recent newspaper report in which the Executive Secretary of the Texas Water Quality Board is quoted as saying that the Environmental Protection Agency is slowing down water pollution control in Texas. My comment is "how do you bring a snail to a screeching halt?" (Laughter.) (Applause.)

[The above-mentioned article follows.]

HOW WE GOT THE DIRTIEST STREAM IN AMERICA

Regulation of Local Hazards -- The Houston Ship Channel

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University of Texas
By Bob Eckhardt*

To evaluate the political and legal aspects of the water pollution problem of the Houston Ship Channel it is necessary at the outset that the two sources of pollution that cause the problem be identified: city sewage and industrial waste. The municipalities, primarily the City of Houston, and the Channel industries contribute to pollution in almost equal magnitude.

It must also be said here at the outset that it is as impossible today to separate politics and pollution control as it would have been to strain the tea from Boston Harbor in 1773, in that first recorded case of water pollution in America. What immediately follows bears out this point:

Because the City of Houston is both polluter and policeman we must expect from it at times the rhetoric of the big stick, the policeman's club, and at other times -- or at the same time -- weak or inconsistent action. Harris County has been more consistent but the county is by its nature within our system the most pecunious and the most impotent level of government.

On the other hand, of the various non-federal agencies of government the State has the greatest reach and tax potential, but it has proved indifferent to the problems of both air and water pollution, as we shall see. The politics of the situation is this:

Both the city and county governments and their elective bodies are all subject to direct political pressures of the local electorate, people who daily feel the direct effects of air pollution. The people in the area also have available to them a dramatic example of the ill effects of water pollution: the Houston Ship Channel. And the residents of Baytown are affected in their daily lives by fish kills in the bays and swamps that form appendages to the Houston Ship Channel and lie adjacent to residential districts in Baytown.

Because of this direct political pressure of people immediately affected by pollution, the county and the city have been more responsive, more sensitive, to the pollution problem than the State has been.

Thus, it is not only the reach of the various political subdivisions that affects the problem but also the pressures working within them upon their elected policy makers. In "I" below we shall consider primarily the City of Houston's contribution both to pollution and to its control.

I. The City as Polluter and Policeman

Houston, The Reluctant Policeman

Within recent months, there has been much discussion of a joint county-city air pollution control program. It will surprise many to learn that such a joint program not only was proposed 18 years ago, but was actually put into effect to apply to both air pollution and water pollution. On October 20, 1953, there was a story in the Houston newspapers to the effect that Harris County industries "will have to toe the line if county officials get into action with the Air and Water Pollution Control Unit it has in mind." The story went on to say that the county hoped to get the municipalities throughout the county to join in the program and support it financially. It was estimated that an effective air and water pollution abatement program could be carried out at the cost of about six cents per capita annually based on the 1950 census. The City of Houston, whose mayor was then the progressive Roy Hofheinz, agreed to contribute 40 percent of the budget, and 16 smaller municipalities agreed to join the program.

But this program fell by the wayside. On September 11, 1956, eleven of Harris County's municipalities were behind on their contributions, with Houston being the biggest delinquent, owing a two-year bill of $58,283. On April 19, 1957, West University Place and Baytown withdrew. Pasadena had never contributed a dime, and the Houston delinquency had grown to $82,603 (for the past three years). So, the joint program collapsed, and Harris County took over the entire program. Thus ended what could have been a meaningful step toward pollution control in Harris County.

Would not citizens, had they been able to envision what has happened today, have been willing to pay the cost of a 6¢ stamp annually to preserve, and to gradually improve, that quality of water which existed then? How much further Harris County would have been in its pollution control program today if this program had been carried to fruition!

Dr. Walter A. Quebedeaux, who headed Harris County's first pollution control unit, in commenting on what might have been had the program survived as a joint program said:

> Undoubtedly, we would have had more funds available. We could have had more personnel, and, in my opinion, we would have been a long way further down the road than we are now.

Why did the joint program fold? Why did the City of Houston fail to live up to its obligations?

Quebedeaux blames the change in administrations.

"Mayor Holcombe did nothing," Dr. Quebedeaux says. "It was useless to go over there and talk to City Council, even though I did continue to send them copies of the annual reports I prepared during that time.

"Assistants to the former mayor (Hofheinz) told the new mayor that the city was morally obligated to live up to its commitments, but the new mayor ignored their recommendations."

When this effort toward a coordinated pollution abatement program collapsed, it was the City of Houston's last participation in water pollution control until January 1, 1971, when a water pollution control department was set up. This shall be discussed in more detail later.

Houston as Polluter

Let us look at the role of the City of Houston as a polluter. It is estimated that approximately 50 percent of the pollution entering the Houston Ship Channel is from the city's multitudinous sewage treatment plants, many of which are inadequate. In this discussion, consideration will be given to the city's role as polluter and the county's role as policeman.

On November 16, 1953, Dr. Quebedeaux was hired as Director of Air and Water Pollution Control Section of the Harris County Health Department. He took over on December 1, 1953. Dr. Quebedeaux faced two major problems: (1) Pollution by Ship Channel industries, some of the biggest names in America's industrial directory; and (2) Pollution by municipalities, one of which was the City of Houston.

Dr. Quebedeaux had been director only eight months when he fired off a letter to Houston's Mayor Hofheinz, pointing out that the city's raw sewage was flowing into Sims Bayou and Country Club Bayou. He charged that the city sewage plant on LaPorte Road was the offender and that dumping was deliberate. Dr. Quebedeaux said the first stage of sewage treatment was bypassed in order that the large particles would not be broken down, thus benefiting the city-operated fertilizer plant. (Incidentally, that sewage treatment plant is still ineffectively treating its effluent.)

Never known as a man of tact, Dr. Quebedeaux drew the wrath of Mayor Hofheinz with this letter. His forthright vigor -- which he was to show many times during the next two decades -- only brought him censure from his employers. The County Commissioners Court sharply criticized him for his condemnation of the city for its inaction on pollution control. This conflict was to continue throughout the years.

On May 8, 1955, the county pollution control officer reported that overloaded city sewage treatment plants were dumping three million gallons of raw sewage into Houston ditches and bayous daily. For instance, the two million gallons per day flow through the Magnolia plant was about three times that plant's capacity. Most of the overloaded sewage treatment plants were taken over by the city by purchase from small water control improvement districts.

The city, in an effort to cope with this problem, diverted the flow from these small plants to larger ones. But this simply meant that, instead of overloading the small plants, it was throwing too much of a load on the large plants; and poorly treated sewage again was being dumped into Harris County waterways. Again, on May 20, 1958, Dr. Quebedeaux reported that more than one-half of the city's sewage treatment plants were "wholly inadequate for safe disposal of waste." Of the 16 plants which were in the old part of the city before the 1950 annexation, he characterized four as good plants, four as mediocre and eight as inadequate. Of the 61 plants in the annexed areas, he said the situation was even worse.

"If you go back through our annual reports on tests that we run in the county, you will find that the City of Houston fluctuates between approximately 68 percent bad ones up to 75 percent bad ones," he says.

"It pretty well stays in the same ball park."

The rapid growth of the city has been its major problem. Throughout the years, it has kept expanding its aeration facilities at its plants, but no sooner does it expand these facilities than it takes in a new area, including smaller sewage treatment plants, and it immediately ties those small plants into the aeration facility and is again overloaded.

"Another problem is the failure of the city to properly chlorinate its sewage," says Dr. Quebedeaux. "Four of its largest plants have no chlorination facilities at all. The reason given is that it would be too costly for the city to chlorinate all of the effluent that comes through those plants."

However, a specific condition of the city's permits from the Texas Water Quality Board requires that it chlorinate. It is required that one part per million of chlorine be residual in the discharge after 20 minutes contact time.

From what has been pointed out, it can be seen how hard it is to make "the horse rake out the stall." It thus becomes necessary to find some other agency or agencies to accomplish pollution abatement. Such may be the county and the courts.

Now let us consider the other half of the Ship Channel pollution problem. In "II" below, we shall consider primarily industry as polluter and the county and the courts as policemen.

II. Industry as Polluter; The County as Policeman

A large part of the problem is, of course, to control the industrial Goliaths along the Ship Channel: steel, paper, petro-chemical and other industries which dump millions of gallons of effluent into the Channel daily. The faded, yellow pages from Dr. Quebedeaux' scrapbook of newspaper clippings tell the story of a few successes, but mostly failures brought about by a lack of support from the Commissioners Court and the State of Texas.

It was on February 25, 1955, that one of the first pollution charges Dr. Quebedeaux brought was decided by Justice of the Peace Walter Queen in Baytown, in which he acquitted Humble Oil Corporation in charges of polluting Scott's Bay.

"This was a case in which Humble was charged with dumping material from its synthetic rubber plant in Baytown," Dr. Quebedeaux recalls. "It was one of the first ones we tried, and we just did not have the right kind of evidence to convince the judge. We lost the first six cases we filed, but we had to learn how."

Dr. Quebedeaux was luckier, or more proficient, in another case decided about six months later (July 12, 1955). He had filed charges of dumping waste materials that were harmful to fish and aquatic life. The companies names as polluters were Humble's Baytown refinery and its synthetic rubber plant and General Tire and Rubber Company. Evidence was presented that discharges were being made by the rubber plant into a main also used by General Tire and Rubber Company. The case, which was tried before a jury, ended with the Tire and Rubber Company being released and Humble being fined the maximum penalty of $100. This was the first recorded conviction obtained by Dr. Quebedeaux in a water pollution case.

The next court cases involved two Ship Channel industries. On September 2, 1955, the county brought charges against Nyotex Chemical Company, Diamond Alkali Company (now known as Diamond Shamrock Chemical Company) and the Merichem Company. The records of two of these companies, Diamond Alkali and Merichem Company, exemplify the poorest effort at pollution control.

"Diamond Alkali was filed on several times, and Merichem Company had numerous charges lodged against them," says Dr. Quebedeaux. "In the first case against Diamond Alkali, it pleaded guilty, paid its $100 fine and fired its superintendent. In another case, it was convicted in Justice of the Peace Court and appealed to the County Court of Law, where the decision was reversed."

Just one week later, on September 9, Dr. Quebedeaux again brought charges against these two recalcitrant firms.

The county, as we have seen, had been working with inadequate legal machinery all along. But it was for the courts to decide how inadequate that machinery really was.

On May 24, 1957, the Court of Criminal Appeals upheld fines imposed upon top officials of individual concerns who had been responsible for violation by their firms of water pollution laws. The decision was hailed as giving the county some real clout in prosecuting polluters.

But on July 1, 1957, just a little over a month later, the same Court of Criminal Appeals in McCollum v. State[1] changed its mind on a motion for rehearing. Though it had found that the plant involved had clearly polluted in violation of Vernon's Penal Code, Article 698b, and that the defendant plant manager had control over the plant generally, the court held that it could not be said positively that the pollution was caused by him as an individual because those under him may not have followed his orders.

This was a critical blow to Dr. Quebedeaux and his program. First Assistant District Attorney Eugene Brady said that pollution laws are useless, for as a practical matter it is impossible to trace pollution to a single employee.

"It had the effect of preventing us from using the criminal courts as a forum to prosecute pollution suits," Dr. Quebedeaux said. "We still had the area of civil courts, but this was a much slower process. Under the court's latest decision it was impossible to find a chain of command unless you found a laborer who actually turned the valve permitting the pollutant to flow into public water. And he was simply following orders. It would not pay to file charges against the lowest man on the totem pole."

After the adverse decision bv the Court of

Criminal Appeals regarding individuals, the county began to file charges against corporations for pollution of the waterways. One of the first cases came up before Justice of the Peace Dave Thompson, but he held, tentatively, that a corporation cannot be tried in Justice Court and reset the case in order to give the District Attorney and Dr. Quebedeaux time to prepare a brief. Just a week later, however, Justice of the Peace Queen, in Baytown, took an opposite view. He fined Jefferson Lake Sulphur Company $200 and costs for polluting Green's Bayou by permitting waste to flow from the Merichem Company plant. This is believed to be the first conviction of a corporation in Harris County on a criminal charge of pollution.

The Corporation Can Do No Wrong

But the sweet taste of victory was not to last long. In mid-1961 came a decision that knocked into a cocked hat all hopes of the county pollution officer to abate pollution. This was a decision by the Court of Civil Appeals in Waco to the effect that a corporation could not be prosecuted in Justice of the Peace courts for violation of air and water pollution laws. Actually, the case concerned an air pollution violation, but the decision constituted a precedent for water pollution cases too. Dr. Quebedeaux had filed a suit against Consolidated Chemical Industries, a division of Stauffer Chemical Company, and Justice of the Peace Dave Thompson had fined the company $100. When the company refused to pay the fine, Judge Thompson attempted to attach $100 in property, and the firm filed suit in District Court for an injunction to prevent him from collecting. It was on an appeal from this case that the Court of Civil Appeals handed down the adverse decision of Thompson v. Stauffer Chemical Company.[2]

Not only was Dr. Quebeaux plagued with adverse court decisions during this period, but he was having a running battle with the county attorney over prosecution of civil cases. On June 22, 1955, the Houston Ship Channel Air Pollution Abatement Committee charged that the county attorney (Burke Holman) was reluctant to perform his duties in handling water and air pollution cases.

Then, on August 28, 1955, County Commissioners Kyle Chapman and V. V. Ramsey asked District Attorney Dan Walton to handle pollution cases and charged that the county attorney had done nothing. A check of the record showed that 19 suits had been filed against polluters in nearly two years of operation of the county pollution control unit and that the district attorney's office had handled 17 of them. The county attorney had handled only two, one of which he had lost and the other had been pending on the docket for several months. The County Attorney blamed Dr. Quebedeaux for his inaction, charging that the county pollution control officer would not furnish him with the information he needed.

Dr. Quebedeaux denied the charge, saying he had, indeed, provided the information necessary. He was supported in his contention by his superior, County Health Officer Dr. L. D. Farragut. Dr. Quebedeaux also said he had provided the county attorney information on three other cases, but the County Attorney had been sitting on them for several months.

"The county attorney was highly reluctant to actually prosecute," Dr. Quebedeaux recalls. "I remember one instance with a firm that was finally prosecuted. I had to make about six different trips out there to see the plant facilities each time, and it just gave the plant management time to try to convince me that they were 'white hat' boys. The case was finally filed by the County Attorney after I had made the sixth trip out there. I told him nothing was changed, and I could see no reason for him to hold back. He was really upset that I had come back with the same opinion after all the pressure had been applied."

A Limited Success

On the other hand, Dr. Quebedeaux found complete cooperation from the District Attorney.

"From District Attorney Dan Walton forward, we had no complaints with that office," he said. "If they had the facts, they would prosecute. There was never any attempt to hold back. Of course, with criminal prosecution, you are required to have a tighter set of facts than in civil cases. For instance, violations have to be recorded on a certain day. But I have no quarrel with that. I don't think I should be in court if I do not have a tight set of facts."

With the adverse decisions by the courts and, in mid-1961, the passage of a so-called water pollution control law by the Legislature,[3] there came a turning point in the battle to control water pollution in the Houston Ship Channel. I will deal with the legislative situation in more detail later, but now let us take a look at the value of the work that the county pollution control unit had accomplished.

On February 22, 1955, Dr. Quebedeaux filed his annual report, in which he painted a rather glowing picture of the Ship Channel:

"We had been in operation a little over a year and had been able to convince the plants that the place to control pollution was at the point of discharge and by getting some of these discharges cleaned up, it had made a big difference in the Channel. We were able to see, at that time, schools of small top-water minnows up and down the Channel. The algae were growing in the Channel, and Nature was recovering from the battle she had been having with unrestricted discharges in the past."

Dr. Quebedeaux reported that, in the entire length of the Ship Channel, there was only about one mile where marine life could not exist, and that was about one-half mile on each side of the Hess Terminal properties. The Hess Terminal case[4] was one of the first cases where the Court of Appeals had ruled against prosecution of a plant official for permitting pollution by his industry.

So, in the face of adverse court decisions, opposition by the county attorney, and failure by the City of Houston to solve its pollution problems, there had been some progress made in cleaning up the Houston Ship Channel. But the worst was yet to come.

The law of nuisance was not adequate as a legal base for pollution control, particularly when criminal law and procedure could not reach a corporation as such. Furthermore, a one-man army, supported by the District Attorney, is hardly enough to successfully attack and conquer embattled industrial polluters in their barbed wire baronies along the Channel. Under these conditions and with a continued brisk growth of industry and attendant increase of industrial effluent into Buffalo Bayou, the quality of the water in that stream was bound to deteriorate.

"The Law is a Ass -- a Idiot"

In the Houston Chronicle on July 10, 1961, there appeared a column which began this way:

> Mr. Bumble's celebrated observation in Charles Dickens' Oliver Twist: "The law is a

ass -- a idiot" will find plenty of agreement in Houston, especially among people who live near the Houston Ship Channel industrial area.

Houstonians are left helpless to control, effectively and legally, the pollution of our air and water. The Waco court leaves it up to the Legislature. But the Legislature failed. Two pollution bills were offered and were lobbied to death. When an individual commits an offense, such as polluting his neighbor's air or water, he can be charged, tried, and convicted. Under Texas laws, a corporation cannot.

The year 1961 was truly a black one for those who yearned for clean air and pure water.

III. Enter: The Texas Legislature

Let us take a look at the situation from the state level. The first attempts made in the Legislature were efforts to rectify inequities in the laws as expressed by the adverse decisions which Harris County pollution control agencies had received.

After the decision of the District Court in the *Stauffer* case,[5] I introduced three bills to rectify the situation:

> H.B. 1007 to amend Article 19 of the Texas Penal Code to include corporations as a suable entity;[6]
>
> H.B. 1010 to provide for criminal process on a corporation;[7] and
>
> H.B. 1026 to provide fines as penalties where corporations were involved, rather than incarceration.[8]

The bills got out of committee, but to get them through at such a stage in the legislative process it was necessary to try to get them considered as uncontested bills. H.B. 1026 was so treated and passed on the local and uncontested calendar on May 25, just four days before adjournment of the 1961 regular session. But the three bills were all a part of a necessary package, and the other two were objected to and struck from the uncontested calendar. An attempt to bring them up out of order was frustrated by a point of order.

The three bills were again introduced, this time early in the session in 1963. Though there was no open opposition to them, the lobby worked quietly behind the scenes to keep them from getting out of the committee. One of my colleagues from Harris County who was thick with the polluters was on the subcommittee. Though he professed to me that he was in favor of the bills, he kept them bottled up. The bills comparable to H.B. 1007, 1010, and 1026 were numbered, respectively, H.B. 186,[9] 185,[10] and 184.[11]

When I could not get the committee to report the bills out, I moved to instruct the Committee on Criminal Jurisprudence to report them on April 18, 1963, but the motion was tabled by a vote of 92 to table to 42 against tabling.[12] The session adjourned on May 24, 1963, without acting on the subject.

The fact that these simple and necessary perfecting amendments to cure the gap in Texas law that made it impossible to hold a corporation guilty of a crime were so effectively fought behind the scenes was a reflection of the cynical attitude of Channel industry toward legal reform in the area of pollution control. The language of the bills had been prepared by District Attorney Frank Briscoe who strongly supported the legislation. But they could not get past one of his former assistants who was on the subcommittee. It is hard to believe that there was not strong pressure from certain Houston polluters to keep the bills bottled up.

It should be remembered, of course, what a happy situation Channel polluters were in under the decision of the Waco Court of Civil Appeals. Stauffer had contended in that case that it could ignore a civil citation of its vice president, absent itself from the trial, and then enjoin the justice court from enforcing its fine because the justice court did not have authority to compel the attendance of the corporation.[13] The Waco court agreed and went further to say:

> Appellant has further urged that the Trial Court held that a corporation may not be charged and convicted of a violation of a criminal statute. The Trial Court did not so hold. Nevertheless, Judge Lynch International Book & Pub. Co. v. State, 84 Tex. Cr. R. 459, 208 S.W. 526, and Overt v. State, 97 Tex. Cr. R. 202, 260 S.W. 856, by our Court of Criminal Appeals, both hold that there is no provision whereby a corporation may be indicted or tried for violation of a criminal statute.[14]

It is perfectly proper for a defendant to use existing procedural law to its advantage, but it is reprehensible for polluters to try to perpetuate the loophole by lobbying against a bill to close it. And it is particularly so when such lobbying is done under cover.

The court had pointed out the failure of the law to furnish necessary procedure, saying:

> . . . There is no procedure in the Code of Criminal Procedure whereby a corporation as such, can be prosecuted for misdemeanor in Texas, and we cannot give our approval to the method employed.

And the court had pointed to the remedy:

> It is our view that the matters of which appellant complains are matters which the Legislature will have to afford relief for, if any relief be afforded.[15]

One is also reminded of how, in 1965, an amendment was placed in the so-called Texas Clean Air Act which nullified all sanctions in the Act.[16] The bill had made it illegal only to violate commission-made rules. But then at the court enforcement stage trial was to be de novo and all commission action was to be considered a nullity.[17] What cynical chuckles must have quivered the jowls of polluters' lobbyists that devised this amendment that nullified the active language of the bill!

Failure of Other Corrective Legislation

Other corrective legislation fared no better. On January 26, 1961, Rep. Roy Harrington, of Port Arthur, had introduced H.B. 34,[18] which would have given a county health officer the right of entry and inspection of premises where he believed a health hazard might exist. At the same time, Rep. Joe Cannon, of Mexia, introduced H.B. 39,[19] which would have raised the maximum penalty for maintaining a public nuisance from $100 to $250. It also would have allowed prosecutors to take such cases to county court where an injunction could be obtained against air pollution and other health hazards.

On February 10, the House Labor Committee sent these bills to a subcommittee after a hearing. The Harrington bill finally passed in the House on April 21, 1961, but died in the Senate.

When Representative Cannon's bill reached the floor on March 7, 1961, Representative Leon Thurman was able to tack on an amendment to strike section 3, thereby emasculating the bill. The amendment would have the result of keeping jurisdiction in the justice court which has no injunctive power. Cannon tried to beat a retreat to the Labor Committee, of which he was a member, so that he could repair the damage, but Representative Jack Woods, no friend of the bill, was able to recommit it to the Committee on Criminal Jurisprudence.

Texas Pollution Control Act

Up until 1961, the state had had no role whatsoever in pollution control. But, on May 23, 1961, the House of Representatives approved a bill to establish the Texas Water Pollution Control Board by a vote of 141-1.[20] However, the bill died in a Senate committee upon adjournment. As this bill was originally drawn, it was somewhat better than the final version which passed subsequently in a special session. The bill passed in May would have established a nine-member Water Pollution Control Board, with four members being the commissioner of the Texas Health Department; the executive director of the Game and Fish Department; the director of the State Board of Water Engineers; and the chairman of the Texas Railroad Commission. The other five members would have represented the following interests: Municipalities, manufacturers, oil and gas industry, agriculture and soil conservation interests, and fish and wildlife. Two of these interest groups were left off the final version of the bill as will appear later.

On August 3, 1961, the State Senate, in a Special Session, passed a substitute bill (22-7) to set up the State Water Pollution Control Board, and it was sent to a Senate-House Conference Committee to iron out differences. It was later passed and sent to Governor Price Daniel for his signature.

There were two bad sections of this bill. One would repeal Article 698b of the Criminal Statutes, which made it a misdemeanor offense to dump waste of any kind into a public stream or watercourse. This was the statute under which Dr. Quebedeaux had had some success in bringing about water pollution abatement. The other section directed the governor to appoint three members to the Board to represent special interests.[21] This is what I call appointing "possums to guard the chicken coop." Those interests were named as: (1) the manufacturing industry; (2) the oil and gas industry; (3) the agricultural and soil conservation interests.[22]

On August 5, 1961, Dr. Quebedeaux wired Gov. Daniel to the effect that if he signed the water pollution control law, it would have the effect of turning Texas streams into industrial sewers. Gov. Daniel answered his telegram to the effect that he also considered it a bad bill, but he did feel that it was a step in the right direction. He also suggested that changes might be made in the legislation during a subsequent special session. Needless to say, lobbyists saw to it that no such changes were made. In the final analysis, I agreed with Gov. Daniel, that, while the bill had two bad sections, it was a step toward state pollution control.

On August 29, 1961, Gov. Daniel signed the bill and appointed members of the State's first water pollution control agency. Named were J. E. Peavy, state commissioner of health; Howard Dodgen, executive director of the State Game and Fish Department; Joe Carter, chairman of the State Board of Water Engineers; J. S. Hudnall of Tyler, representing the oil and gas industry; C. M. Shigley, assistant general manager of Dow Chemical Company, representing the manufacturing industry; and Sam Wohlford, representing the agricultural and soil conservation interests.

The Polluters' Briar Patch

The polluters, like "Br'r Rabbit" had been thrown into the briar patch. Such was a politico-administrative thicket with which they were familiar and in which they felt at home. They were amongst friends in the administrative agency. Yet all this was done in the name of getting clean water and was done with a great show of piety.

Pollution abatement in the Houston Ship Channel came to a standstill. High-powered lobbyists, being threatened at the local level, had thwarted attempts to amend the laws so that local officials might haul their clients into court. Then, to make it a leadpipe cinch, they had been instrumental in passing a law setting up a paper tiger Water Pollution Control Board made up mostly of persons from the industries to be controlled. From late 1961 until the Legislature in 1967 approved the Texas Water Quality Act,[23] the hands of environmentalists were tied.

The newly-created State Water Pollution Control Board was a show-case agency, as so many agencies are. On February 7, 1964, Chairman Joe Carter was quoted as saying that he opposed federal water quality standards. However, he piously said, "All applications and permits are dedicated to the proposition of preserving the purity of the streams."

Yet, during that same year, the Texas Water Pollution Control Board adopted a so-called "zoning" plan for the Houston Ship Channel, a proposition supported only by the big industrial interests of Harris County. On June 10, 1964, the Port Commission urged that the Ship Channel from Morgan's Point to the Turning Basin be zoned as industrial water -- not for recreation. The Board was in the process of setting a public hearing to establish water quality criteria for a 25-mile stretch of the Channel. And the Houston Chamber of Commerce joined the Port Commission in contending that the primary best use of the Ship Channel and its tributaries was for commerce and industry.

On February 25, 1964, the Texas Water Pollution Control Board said it was considering an order that the Houston Ship Channel waters be of such quality as to protect the Galveston Bay system for recreation, oyster production and fishing. Its proposed order would apply in the stretch of the Channel from the San Jacinto Monument to the point of influence from tidal waters. This was window dressing. On October 29, 1964, the Board announced its "zoning" concept. The upper Ship Channel area would be classified as an "industrial" zone, the area from the San Jacinto Monument to Morgan's Point would be a buffer zone, and from Morgan's Point out into the bay would be classed as a recreational area.

The trouble with this concept, as I pointed out at a hearing on the proposed new rule, was that the Water Quality Board had mistaken the Houston Ship Channel for a babbling brook making its way to the sea. But the Ship Channel does not aerate itself over pebbles and stones, and its waters do not move regularly and progressively down its course. With about a 40-foot decline throughout its course to Galveston Bay, its waters lie stagnant in deep places, sometimes dammed in by high water in the bay held there by southeasterly winds. Then, when the rains flush the great commode of the Turning Basin, all the "crud" of the Channel flows down toward the sea, sometimes being diverted into Scott's Bay or Burnett Bay where multi-thousands of mullet are suffocated and poisoned by the oxygen-depleted and poisoned waters.

On November 11, 1964, one of the biggest fish kills in years was recorded. Hundreds of acres of dead mullet, crabs and drum washed onto the shores of Baytown subdivisions. Dr. Quebedeaux blamed this kill on an outpouring of industrial waste into the Ship Channel and said that Channel industries, encouraged by the zoning plan, had opened their flood gates and discharged substances that should not have been released.

"The Ship Channel waters are of poorer quality now than they have been for a long time," said Dr. Quebedeaux. He said that the decision to zone the Channel gave industries "a license to extend polluted waters far south of the main Channel area and that the Texas Water Pollution Control Board had met secretly with the Chamber of Commerce officials to map its zoning proposal. He also charged that the new board had not filed a single suit since it was formed in late 1961.

So the period between 1961 and 1969, when a few meaningful amendments to the Texas Water Quality Act were passed, actually contributed little to pollution abatement in the Houston Ship Channel. The Texas Water Pollution Control Board issued permits to industries and municipalities and did little or nothing to ensure that the effluent was being upgraded to improve the receiving waters. As James Quigley, Commissioner of the Federal Water Pollution Control Administration, said in Houston in 1967: "I consider these waste discharge permits and Texas' grandfather clause nothing more than a permit to pollute."

Creation of Texas Water Quality Board

In 1967, the legislation to establish the Texas Water Quality Board was enacted.[24] This was somewhat of an improvement over the Water Pollution Control Board. At least, the new act did not specifically direct the governor to appoint members to represent special interests, though to look at some appointees, it would seem at times that governors have generally followed that practice.

For instance, Howard Rose, a former assistant to Governor John Connally, was appointed by Connally to the Texas Water Quality Board. Rose, a member of an Austin law firm, has long been a lobbyist, and it was not unusual, when Rose was Chairman of the Board, to see him leave a meeting of the Board and go directly to a legislative meeting to lobby for or against legislation affecting his clients.

Also, Governor Preston Smith's latest appointment to the Texas Water Quality Board represents what I consider to be a major conflict of interest. How can Lester Clark, president of an oil company, holding interests in two banks and serving as a member of the board of directors of the Mid-Continent Oil and Gas Association, represent the welfare of the general public when he votes on water pollution control? As long as appointments like these are approved, then the public will continue to breathe dirty air and use dirty water.

Though involving another agency, the appointment by Governor Connally of John T. Files of Merichem Chemical Company as chairman of the Texas Air Control Board in 1964 is appropriate for mention. On the basis of the number of individual protests against his company about air pollution from the company's stacks, he was on several occasions designated by Dr. Quebedeaux as "polluter of the month."

Since Howard Rose's retirement to go back to his law firm, Gordon Fulcher has taken over as Chairman of the Texas Water Quality Board. At first, I was encouraged by Fulcher's attitude toward polluters, but have been disappointed by some recent actions. In the last few months, Fulcher has been jousting heatedly with the City of Houston over its lack of success in coping with its pollution problems. The Board has filed few legal actions against polluters since its inception in 1967; and, since the state has failed so badly, for it to be so sharply critical of the City of Houston seems more of a distraction of attention from state inaction than fair criticism.

IV. Federal Pollution Abatement

I have heretofore pointed out the political pressures that tend to make local government responsive to local demand for cleaner air and water. Let us look now to the Federal Government and compare its responsiveness to that of the state.

Most of the population of the United States lies in cities where air and water pollution problems are acute. These are the places that dump the largest amounts of sewage in the rivers, the areas that use and reuse water. It is these same heavily populated areas which exercise the clout in Congress, in the nominating conventions for the President and the Vice

President, and in the presidential elections. Therefore, the Federal level is, like the local level in a place like Houston, sensitive in matters relating to the quality of air and water.

On the other hand, most of the Texas legislators are from areas so little affected immediately by air and water pollution that the law makers are not as likely to respond to local, constituent pressures as they are to lobby pressures. The sweet scent of bourbon that blows over an old-fashioned is more likely to activate them than the foul scent that blows over the black and fetid waters of the Turning Basin, which is far away from them and their constituents. That is perhaps the reason why it has been the Congress that has moved positively and effectively in the areas of air and water pollution and not the legislatures.

Some of the same considerations affect the Governor and his state bureaucrats. Let me cite an example:

Under the Federal Clean Water Restoration Act of 1966 (PL 89-753) provisions were made for a sharing plan to provide funds for sewage treatment facilities whereby if states provided 25 percent of the matching funds, municipalities could finance such facilities by providing 20 percent of the capital, the Federal Government providing the remaining 25 percent.[25] If the state provided no funding, the local municipality in most instances would pay 70 percent and the Federal Government 30 percent, and the Federal share could never exceed 33 per cent.[26] The State of Texas has never provided its share, and Texas municipalities have lost millions of dollars in Federal grants for sewage treatment facilities as the result.

In 1969, when United States Representative John Dingell wrote the states asking if they could use more funds in this effort, Mr. Hugh Yantis, the Executive Director of the Texas Water Quality Board, answered in the negative. Not only did he write Congressman Dingell, but sent a similar letter to Representative George Mahon, Chairman of the Appropriations Committee. When an amendment came up on the floor of the House to increase appropriations for this program from $600 million to $1 billion annually, it failed by two votes. Ultimately, Congress compromised at $800 million. But those two votes cost the states $100 million apiece in sewage treatment facility funds. I think there is little question but that two more votes would have been garnered from Texas alone had the Governor and his agent acted in concert. (Governor Smith wired the delegation urging support of the Dingell amendment.)

I would like to turn now to the role of the Federal Government in cleaning up the Houston Ship Channel.

For a brief time back in 1958, the United States Attorney's office in Houston was moving to enforce two anti-pollution statutes -- the Oil Pollution Control Act of 1924[27] and the Refuse Act of 1899.[28]

Dr. Quebedeaux reports that the Oil Pollution Control Act was used primarily in trying to control dumping and leakage of pollutants from tankers and barges. He says:

"The common practice was, when a barge or tanker became so battered in the heavy seas of the Gulf and started leaking, the company would place them in Channel service. And, as a result, they soon had a leakage problem."

Refuse Act of 1899

So the Refuse Act of 1899 was put into play by the then Assistant United States Attorney James Ross. On August 26, 1958, the Federal Government filed charges against four firms for polluting the Ship Channel and Green's Bayou. Charged were Eastern States Petroleum Chemical Corporation; Diamond Alkali Company; Consolidated Chemical Industries, a Division of Stauffer Chemical; and Index Chemical Company. Just two days later, Ross filed additional charges against Consolidated Chemical Industries, Eastern States Petroleum and Chemical Corporation, and the Hard Lowe Company.

What became of these cases? The cases against Consolidated Chemical Industries were thrown out by the judge because the firm had been discharging through a sewer, one of the exemptions. The Hard Lowe Company was fined $500 for polluting Clear Creek with liquid copper chloride after pleading nolo contendere. Index Chemical Company was found not guilty of charges of polluting Greens Bayou by United States District Judge Joe Ingraham. The judge said he had reasonable doubt that the carbon disulfide came from the Index plant. There is no record in the newspaper files of what happened to the other companies charged.

Assistant United States Attorney Ross was highly complimentary of the efforts of the county to clean up the Houston Ship Channel. "The Harris County Air and Water Pollution Control Unit has done much in the past two years to clean up pollution in the Houston Ship Channel," he said. "With the exception of a two-mile strip, the Channel is in good condition."

Uncle Sam Winks at Illegal Pollution

But the Federal role was doomed to die. On February 2, 1959, the United States Attorney was ordered to hold up further prosecution under both the Oil Pollution Control Act and the Refuse Act of 1899. The Justice Department and the Army Corps of Engineers were reportedly reviewing the basic policy involved, and United States Attorney William Butler said he had been instructed by Washington not to prosecute any more cases without specific authority. Then on February 6, 1959, it became official. The United States would not prosecute any more cases of polluting the Houston Ship Channel unless they involved obstruction of navigation. The Justice Department said it would be swamped if it had to prosecute every case of pollution of a navigable waterway.

"That's an age-old excuse," says Dr. Quebedeaux. "I've seen it in other areas. When the Legislature did not want to put teeth in a pollution statute, it would charge that such a move would cause the courts to be overcrowded. My experience has been that if you prosecute a mere handful of people, the rest of them will not need it."

Dr. Quebedeaux feels that the withdrawal of the Federal Government from Ship Channel pollution control was a severe impediment to Channel water quality protection.

"If the Federal Government had maintained its position, I do not think the Ship Channel would have gotten into the sad state it was in in 1961," he said. "When Jim Ross left the department, there were 12 cases pending which were immediately dismissed by the new Assistant United States Attorney."

Uncle Sam Quits Winking

The Justice Department has now reversed its policy of winking at big lawbreakers in the pollution game. The United States Attorney's office in Houston has assured me that it will now again prosecute under the Refuse Act of 1899 just as in other cases of lawbreaking. At the present time, Assistant United States Attorney Andrew J. Shepherd, who is in charge of the Admiralty Docket, is investigating no less than 25 "continuous" polluters with a view toward bringing charges against them. And I have been assured by both Mr. Shepherd and the Environmental Protection Agency office in Houston that the Environmental Protection Agency is cooperating and will continue to cooperate with the United States Attorney in this endeavor.

This is in accord with the policy enunciated by the new Environmental Protection Agency headed by William Ruckelshaus, a former Assistant United States Attorney General. Senator Birch Bayh, who knows him -- he was Bayh's opponent in the last campaign -- thinks the new EPA Administrator will do a good job if he is permitted to do so by the Administration.

Senator Bayh says: "It all depends to which drum beat he is permitted to march." And we cannot fail to recall what happened to Secretary of the Interior Hickel after he cracked down on the large firms which were devastating our coastal waters with oil spills.

With enactment of the Water Quality

Improvement Act of 1970,[29] which sets stiff penalties on companies that permit oil spills to damage the environment, and with active prosecution of other polluters under the Refuse Act of 1899, I believe there can be a marked change in water quality in the Ship Channel and Galveston Bay.

V. The Prospects and Some Recommendations

What does the future hold for the Houston Ship Channel?

Those of us who are earnestly concerned about the environment find some reason for cautious optimism. There is basis for a ray of hope that actions are in the offing which will begin to reverse the degradation of this body of water.

The City's Encouraging New Programs

In addition to the Federal Government's rejuvenated program, for the first time since the joint city-county pollution control program was aborted in 1953, the City of Houston has a water pollution control director. Headed by Victor Howard, the department has a chief of field operations and six technicians. It is only two months old and is adopting a rather cautious approach. It is presently seeking out unregulated discharges -- that is, discharges from sources which do not hold a waste discharge permit from the Texas Water Quality Board. Howard has set up operations on six of the main bayous feeding into the Ship Channel and has ten stations on each bayou. His technicians are taking samples and analyzing them in an effort to determine where particular pollutants are originating.

It is too early at this time to determine if the city's water pollution control program will take the tough attitude that its air pollution control program is now taking. I think that local pollution control can be more effective than state control because those charged with enforcement are closer to their constituency.

County's Role Vitalized

As far as the county is concerned, it is just now bouncing back into an effective role which had been curbed by the adverse court decisions, the toothless legislation setting up the State Water Pollution Control Board in 1961, and the emasculating provisions of the act creating the State Water Quality Board in 1967, limiting local authority. Environmentalists, buoyed by a more responsible State Senate, were able to beat back the lobbyists in 1969 and get some amendments to the Water Quality Act passed. For instance, the county is now able to bring criminal charges against corporations -- what I had sought in 1961 and 1963.

Just as this paper is being prepared Harris County has won an important court victory.[30] Judge A. C. Lesher, Jr., of the 157th District Court, has just issued a temporary injunction against Rhodia, Inc., Chipman Division, ordering the pesticide manufacturer to halt the discharge of arsenical material into Vince Bayou.[31] Also, the court issued a mandatory injunction requiring the company within sixty days to abate the possibility of arsenic leaving its property and requiring it to clean up its neighbors' property. During the course of the suit, Dr. Quebedeaux testified that samples taken from the outfall and surrounding soil had indicated there was enough arsenic in the soil to kill 2.8 million persons -- more than the population of Harris County.

Foot-Dragging at the State Level

State action is, as in the past, the most discouraging. Between 1961, when the State Water limiting local authority. Environmentalists, buoyed by a more responsible State Senate, were able to beat back the lobbyists in 1969 and get some amendments to the Water Quality Act passed. For instance, the county is now able to bring criminal charges against corporations -- what I had sought in 1961 and 1963.

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Foot-Dragging at the State Level

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Pollution Control Board was appointed, and 1967, when the Texas Water Quality Act was passed, the State filed not one charge of violating water pollution statutes. There were two cases heard on appeal when the Board had granted waste discharge permits and citizens had appealed the decision to grant them. But the State won both cases[32] and the polluters were allowed to continue polluting. Since a few snaggled teeth were put into the Act in 1969, however, the State has moved somewhat faster, but still not fast enough. Roger Tyler, assistant attorney general and chief of the Water Division of the Texas Attorney General's Office, tells me that the State has filed only five charges of water pollution violations in Harris County since September 1, 1969, when the amended Texas Water Quality Act went into effect. The State, however, has joined in six other cases brought by the Harris County Pollution Control Section. It is interesting to note that most of the companies filed on by the State are rather small ones, while four of those tackled by the county are the giants of industry on the Ship Channel -- names like Olin Corporation, Rhodia, Inc., Goodyear Tire and Rubber, and Rohm & Haas Company.

One of the key amendments to the Texas Water

Quality Act approved in 1969 was a change in the wording of the Act. Previously, waste discharges, or threats of waste discharges, affecting water courses in Texas had to cause "pollution" to be a violation. The new act reads: "(a) Whenever it appears that a person has violated or is violating, or is threatening to violate ... any ... permit ... then the board, or the executive director when authorized ... may cause a civil suit to be instituted."[33] Another amendment sets a fine ranging from $50 to $1,000 for violations, with each and every day and each and every act a separate offense.[34]

In one of the cases in which the State has intervened (the Rhodia Case mentioned earlier), it has taken the most active role it has taken in any case, and we have seen the results. Other cases, however, have shown a safe attitude toward the polluter on the part of some officials. Furthermore, there has been in the past a lamentable practice of the Texas Water Quality Board staff of quickly amending a waste discharge permit when it discovers that a county enforcement agency is planning to file a charge. These conclusions have been confirmed by the Attorney

General's office.

My conclusion is found in the testimony presented as recently as March 17 of this year by Mr. Tyler to the Senate Finance Committee of the Texas Legislature. In it, he documents point by point the failure of the Texas Water Quality Board to move to adequately enforce present water pollution control laws. Among the points he makes are these:

1. The Board is not using local health authorities in preparing enforcement cases.

2. The Board needs to re-evaluate all existing waste discharge permits. Some old permits need to be rewritten.

3. The Board gives too much publicity to cases before filing.

4. There are unnecessary delays in processing waste discharge permit applications.

5. There is a need for more coordination between Board staff people and the staff attorneys of the Board with the Attorney General's office.

6. Often too much credence is given to an alleged polluter's claim that he cannot clean up, rather than toward gathering facts for an effective enforcement program.

These are only half of the charges that Mr. Tyler made in his presentation, and I think the last one mentioned is perhaps the most important one. It is spotlighted by a recent case against French Ltd., which had been given three years to solve its pollution problems in northeast Harris County. Hugh Yantis, the Board's executive director, came back in March with a proposal to give the company another year in which to correct the problem. The Board, however, in a rather unusual display of militancy, ordered the company to immediately halt operations and to clean up its pit which had been used for disposal of industrial waste. Furthermore, in an executive session, it ordered Mr. Yantis to get tough "or else." And Chairman Fulcher explained that the "else" means to get tough or get fired. This is, indeed, encouraging, and it buoys our hopes that the State, at last, is moving in the right direction in enforcement.

Regional Authorities

There is another area of services and control that is becoming of importance. If pollution is to be attacked from a broad base, there must be a governmental device that can cross traditional political boundaries to pursue the source of such problems where they originate or where the effects are felt. For instance, the people of Galveston are vitally affected, and should be considered, by what occurs in the Houston Ship Channel. Whatever is discharged in Galveston Bay must eventually pass by Galveston on its way to the sea.

One such agency was created by the Texas Legislature. Created in September 1969, the Gulf Coast Waste Disposal Authority was organized in February 1970 and started its staff in June of that year. Not yet a year old, we cannot judge its effectiveness, but it does have sufficiently broad powers to accomplish a great deal. The Authority has power to plan, recommend standards, do research, enforce standards and to build and operate waste treatment facilities. The measure of its success will depend on the ability to fund its activities in the enforcement and regulatory phase of its work.[36]

The Authority has already undertaken several projects that will provide waste treatment for industries and cities in the Houston area. Under these arrangements the participants pay all costs of the treatment facilities and the operation and maintenance costs. No tax money is required for this phase of the Authority work. The primary benefit to the public is found in the fact that a governmental authority, and not a private industry or other discharger, will have control of the final effluent.[37]

This regional concept is the first of its kind in the nation, where both enforcement and implementation are placed under one authority. Only time will tell whether the Gulf Coast Authority will be able to coordinate the efforts of local governments in one area to afford a broad approach to the pollution problem. The public will decide this role since it must make the decision on whether to tax itself to provide regional control measures.

Some Conclusions and Recommendations

1. The Water Quality Act still needs perfecting and State Representative Rex Braun is pressing for several amendments in this session of the legislature. One of his bills[38] provides that any waste discharge permit issued by the State Water Quality Board requires concurrence by the city or county in which it is granted. Should such a permit be issued by the State without such concurrence, it would be invalid and the company involved would be

subject to prosecution. A second Braun bill[39] would allow city or county governments to set stricter water quality standards than the State sets. A third bill offered by him[40] would let a municipality file charges against a polluter even though the polluting company is located outside the city's jurisdiction. Another extremely important Braun bill[41] would give private citizens standing to sue corporations or state regulatory agencies for degradation of the State's natural resources, including air and water. At this time, it is evident that lobbyists are fighting Representative Braun's proposals, for passage of them would give pollution fighters such as Dr. Quebedeaux a clear field to haul polluters into court.

2. All facilities of all agencies at all levels of government should be put at the disposal of each other agency. If Harris County needs help from the City of Houston in taking samples from streams or discharges, then the City of Houston should oblige. If the City of Houston needs help from the Federal Environmental Protection Agency, then that agency should do whatever it can.

3. I would like to see the Federal Environmental Protection Agency adopt new water quality standards. The so-called "zoning" of the Houston Ship

Channel in 1964 was a farce concocted by an engineer on the industry-controlled Water Pollution Control Board, and the farce is still being foisted upon Harris County citizens. The present Water Quality Board has used this concept as part of its water quality standards submitted to the Federal Water Pollution Control Administration in compliance with the Federal Water Quality Act of 1965.[42] This statute required states to adopt water quality standards to be approved by the FWCPA, and standards were to be adopted for each body of water according to its particular use -- i.e., for industry, marine life reproduction, or recreation, et cetera. But I do not recall that the Federal Water Quality Act of 1965 permitted the State to divide a body of water into three different zones, each to be of a different quality. And whether there is authority to do this or not, it should not be done, for reasons I have pointed out above. So I would urge the EPA to require new, more stringent water quality standards for all waters, navigable, interstate or intrastate.

4. Then, generally, I think that all the agencies must adopt the attitude that those who pollute in violation of clearly established standards are law

breakers and should be treated as such. Their permits should not be revised to make the act fit the legal permission, and they should not be able to profit by their offenses because it is deemed of greater social value to lighten the burden of the courts' dockets than to lighten the burden upon people and upon the environment -- a burden which is occasioned by dumping industrial garbage in that great street on which our industry resides, the Houston Ship Channel.

5. Perhaps it goes without saying that the good ongoing or uncompleted programs should proceed, but I shall say so if only to emphasize (1) the importance of the completion of the consortium of river authorities as an agent acting for the state to raise 25 percent of the cost of waste treatment plants so that municipalities and other public agencies may get 55 percent matching funds under the Clean Water Restoration Act and (2) the importance of passing the bond issue for the same purpose respecting future Federal funds. As has been said, this important and desirable constitutional amendment comes up on May 18 for approval or rejection by the people.

While there are those among us who lament

Federal intervention, it is evident from the history of two decades of state inaction and refusal to get tough with polluters that whether we get a decent quality of environment rests with local entities or the Federal Government -- at least in the enforcement area. Likewise, it is for all intents and purposes certain that it will be the Federal Government that puts up the money for water improvement. However, the State is showing signs of cooperation in making money available to its municipalities and subdivisions for this purpose.

To clean up, or at least improve, the inky black Bayou we must press as hard as we can at those levels of government and in those areas of control as give promise of most results. Perhaps this paper will serve as something of a guide as to what agencies are most likely to produce in what particular ways.

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*U.S. Representative, Texas; Member, Texas House of Representatives, 1958 to 1966.

[1] McCollum versus State, 305 S.W.2d 612,165 Tex. Crim. 241 (1957).

[2] Thompson versus Stauffer Chemical Company, 348S.W.2d 274 (Tex. Civ. App. -- Waco 1961, writ ref'd n.r.e.).

[3] Tex. Rev. Civ. Stat. Ann. art. 7621d (1969).

[4] _See_ note 1 _supra_.

[5] _See_ note 2 _supra_.

[6] H.B. 1007, 57th Tex. Leg., Reg. Sess. (1961).

[7] H.B. 1010, 57th Tex. Leg., Reg. Sess. (1961).

[8] H.B. 1026, 57th Tex. Leg., Reg. Sess. (1961).

[9] H.B. 186, 58th Tex. Leg., Reg. Sess. (1963).

[10] H.B. 185, 58th Tex. Leg., Reg. Sess. (1963).

[11] H.B. 184, 58th Tex. Leg., Reg. Sess. (1963).

[12] Vote on H.B. 185, Tex. H.R.J. 1189-90, 58th Tex. Leg., Reg. Sess. (1963).

[13] Thompson versus Stauffer Chemical Company, _supra_ note 2, at 275.

[14] _Id_. at 276.

[15] _Id_. at 275.

[16] Amendment to Committee Amendment 1 to H.B. 362, adding § 14 of the final bill. 59th Tex. Leg., Reg. Sess. (1965).

[17] Id.

[18] H.B. 34, 57th Tex. Leg., Reg. Sess. (1961).

[19] H.B. 39, 57th Tex. Leg., Reg. Sess. (1961).

[20] Vote on H.B. 130, Tex. H.R.J. 2426, 57th Tex. Leg., Reg. Sess. (1961).

[21] Note 3 supra, § 3(a).

[22] Id.

[23] Note 3 supra.

[24] Id.

[25] 33 U.S.C.A. § 1153 (1966).

[26] Id.

[27] Oil Pollution Act of 1924, 33 U.S.C.A. § 431 (1964).

[28] Refuse Act of 1899, 33 U.S.C.A. § 407 (1964).

[29] Pub. L. No. 91-224 (1970)

[30] Harris County versus Rhodia, Inc., Civ. No. 853,872, Dist. Ct. of Harris County, 55th Judicial Dist. of Texas (1971).

[31] *Id.*

[32] City of San Antonio versus C.D.J. Enterprises, Inc., 402 S.W.2d 573 (Tex. Civ. App. -- Austin 1965, writ ref'd n.r.e.); Corder versus State Water Pollution Control Bd., 391 S.W.2d 83 (Tex. Civ. App. -- Austin 1965, writ ref'd n.r.e.).

[33] Note 3 *supra*, § 4.02.

[34] *Id.*

[35] *Id.*

[36] *Id.*

[37] *Id.*

[38] H.B. 69, 62nd Tex. Leg., Reg. Sess. (1971).

[39] H.B. 360, 62nd Tex. Leg., Reg. Sess. (1971).

[40] H.B. 276, 62nd Tex. Leg., Reg. Sess. (1971).

[41] H.B. 56, 62nd Tex. Leg., Reg. Sess. (1971).

[42] Federal Water Quality Control Act of 1965, 33 U.S.C.A. § 466 (1965); Water Pollution Control Act, 33 U.S.C.A. §§ 466g, *et. seq.*, §§ 1151, *et. seq.*

CHAIRMAN STEIN: Thank you, Congressman Eckhardt.

Since you said that the EPA people had done their homework, let me say that after listening to your presentation, I am sure you know what "homework" is. That was an exceedingly comprehensive statement.

I wonder if we could ask our staff members to get in touch with your office so we can get these charts in a form that we can insert in our record. Would that be appropriate?

MR. ECKHARDT: I assume that you ordinarily work up the transcript and make it available for some editing. If you do that, I will make my changes with respect to the references to the charts and work up some black and white charts if that will be all right?

CHAIRMAN STEIN: That will be made available to you.

MR. ECKHARDT: Thank you.

CHAIRMAN STEIN: Are there any comments or questions?

MR. JOHN QUARLES: I would like to comment briefly, if I might.

At the beginning, I might explain that my role at these proceedings is largely a matter of sitting in and observing in order to obtain some first-hand feeling for the factual situation that exists here.

I will be here today and tomorrow and will not be able to be here for the conclusion of these proceedings, assuming that they do proceed beyond Tuesday.

With regard to many of the points which you made, Congressman Eckhardt, in your presentation, I don't think it is appropriate for me to make any response because our purpose is to sit as a fact finding panel and hear the story as it unfolds from all of those who would wish to make a presentation.

I would like to respond before any period of time is allowed to give any credence to the suggestion that you made, however, that there may be some tendency within the Environmental Protection Agency of doing a job that is a "soft touch" in dealing with pollution problems.

That is not our intention and I assure you that is not what we shall do. By our actions, you may judge us, and I think the record which we have begun to establish and which I have every confidence we will continue to establish will be a record of comprehensive, concrete efforts to reduce the pollution problems around the country, taking action in a positive way where it is called for.

The conference sponsored by the National Association of Manufacturers that you referred to was one in which I was one of the principal participants, and I appreciate the fact in referring to that, you referred to the newspaper accounts of the conference rather than the conference itself.

I do not believe there were any statements made in that conference by myself or by the Administrator, Mr. Ruckelshaus, or by others that would have justified the conclusion that we were inclined to adopt a "soft touch."

Our position has been and will be that we do not want to take action in individual cases until we have had an opportunity to explore fully the facts that are involved, and, wherever possible, to obtain a solution to the problem through voluntary undertaking of pollution control efforts by the municipalities or the industries that may be involved.

We have expressed on that occasion and on many others our concern to provide an opportunity to all of those who are now contributing to the pollution problems who recognize the need for a stepped-up level of control of those problems and to undertake such actions as are called for without suffering the unfair publicity that may occur from the litigation or other forceful actions that we may be required to take.

And, indeed, this entire enforcement conference is undertaken with that spirit on our part; that we have come here not to accuse or to condemn, but rather to explore the subject and to work in a cooperative fashion with all of those who are concerned and to take a positive, constructive approach to improving water quality to see what we can do.

So, I would simply close by repeating the comments that the Chairman made in appreciation of the obvious attention that you have given to these problems. I was aware from a previous meeting we had in Washington of your own personal commitment to improving environmental protection and improving water quality in Texas, but I am even more impressed by that personal commitment and personal familiarity which you have demonstrated to us now.

Other than that, as I said, I won't comment on the substantive report you made, but I would like the record to be made clear on our own position in approaching the problems.

MR. ECKHARDT: May I comment briefly?

MR. RICHARD VANDERHOOF: Yes.

MR. ECKHARDT: We very much appreciate the attention the EPA gave to our very difficult problem of trying to take care of monies that were available to Texas that would have run out on May 15 and on June 30 if action had not been taken immediately through the compact of water authorities, and we very much appreciate your immediate attention to that matter because, as you now see, we were serious in reserving the monies permanently in passing the bond issue, but without your excellent cooperation and that of the Water Quality Board and of the river authorities, we would have lost, I think $50 million.

Now we may save all of that. I say hopefully that we "may," and I have some indication that we may, but certainly it will be a very substantial aid to meeting this problem, and certainly you are entitled to the greatest commendation for your cooperation on this matter.

We deeply appreciate it.

And I would like to say briefly to the comment about the meeting that you referred to: I am in politics myself, you know. (Laughter.)

I know that at times there are comments that might have other context.

I never criticize newspapers because they have the last word and usually they are reasonably accurate. (Laughter.)

But it can be said that you can talk about a soft approach in a sense which is not necessarily bad.

I think in the area of water quality, there is such a tremendous stake in industry to reuse its water, to recycle, to make the absolute maximum use of water that is available that in the long run, we have a built-in tendency toward enforcing the Act.

Hon. Bob Eckhardt

I think industry, in general, wants to enforce the Act because it is greatly to its advantage.

I think there is a difference in water pollution and air pollution in this respect because water is exhaustible, and from industry's standpoint air is not.

So, I am firmly of the opinion that you have built into the Act pressures which call on industry to govern itself to a large extent, and I don't mean by anything that I have said here to make a blanket attack at industry, but the only thing is that when industries are competitive with each other, and when the program is at this stage, it seems to me it becomes necessary to apply uniform enforcement to all so that those who would make the maximum use of recycled water will not be at a disadvantage for doing so.

So, I can understand how even the quote that was used in the paper could be a part of a total expression at a meeting and still not be bad.

The thing is: None of us wants to be harsh, but I think we must be positive.

Thank you, sir.

CHAIRMAN STEIN: Thank you.

Are there any other comments?

(No response.)

CHAIRMAN STEIN: If not, may we recognize Don Jansen representing Congressman Bill Archer?

Mr. Jansen.

THE HONORABLE BILL ARCHER
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.
(Presented by Don Jansen)

MR. JANSEN: Thank you, Mr. Chairman.

For the record, I am Don Jansen. I am here on behalf of Congressman Bill Archer.

Congressman Archer has expressed his regrets he personally could not attend this series of hearings because business in Congress has kept him up in Washington. But he will have representatives throughout the full 3 days or longer, as you indicated, because you are going to listen to everyone, as you say, and they will be reporting back to him periodically on these proceedings.

Even though the Ship Channel and Galveston Bay are not in his District, he too has a great concern, because they do affect the people of Houston and the citizens of the State of Texas. And he like every other citizen is concerned about pollution problems in these great areas.

The Congressman will be reading over these proceedings and reports to see if there is any way in which he or Congress can further assist in solving the problems.

I thank you very much for your time, sir.

CHAIRMAN STEIN: Thank you, Mr. Jansen.

We are off to a flying start. We will listen to everyone. I hope the rest will be as germane and relevant as what we have had up until now.

Representative Rex Braun of the State of Texas.

THE HONORABLE REX BRAUN
REPRESENTATIVE, STATE OF TEXAS
HOUSTON, TEXAS

MR. BRAUN: Chairman Stein, gentlemen, ladies and gentlemen. Unlike Congressman Eckhardt, who operates under the filibuster rules, we, on the State level, have a 10-minute time limit, and I will try to stay within that. (Laughter.)

CHAIRMAN STEIN: The House has a 5-minute debate level.

MR. BRAUN: We have a 3-minute amendment limit, and I will try to stay within that.

I have represented the Houston Ship Channel for some 6 years on a State level.

This is, of course, the industrial complex and the greatest petrochemical complex in the United States.

Again, like Congressman Eckhardt, I don't know what my district will be. I think the courts will settle that. I may be representing Memorial Drive. (Laughter.)

Hon Rex. Braun

My remarks, gentlemen, will be in a general nature because I am not a "technocrat" but a victim.

As you can see, I have spent some 5 months in Austin in the good clean air up there and came home for a long weekend and you see the results (indicating throat condition).

That is the kind of area in which I live and represent.

My remarks will be directed to you people on a Federal level -- the EPA. First, I want to welcome you on behalf of myself and the people I represent, because, as I said in 1967 to Commissioner Quigley and his Commission for Water Quality and the Presidential Commission, the people in this area do not care who cleans up that mess, whether it is the Federal Government, State government, local government, or International Monetary Fund. And I repeat that to you today.

Now, as far as the State agency, I think Congressman Eckhardt did a fine job of reporting to you on what has gone on in the past almost 10 years. I concur with those remarks

I think our Board's rhetoric has improved, but I am waiting to see. I have to say, as I have said before, their staff, their philosophy has been soft on polluters and has coddled the polluters of this State.

Until we get the kind of action we need from this centralized authority in Austin, the State Water Quality Board, we will still have the degradation of the environment in this area.

As to the local government, I think our problem lies in that they are hamstrung by our weak and inadequate laws, which the Texas Legislature has seen fit to pass, and our hope lies with you.

We have just finished another 5-months' session, which I consider is another waste as far as the environmental field is concerned. We passed nothing meaningful, only laws that would comply with your already Federal regulations.

There were many good, fine bills, antipollution bills, introduced -- both air and water. But they died in committee as they have always in the past. I am afraid sometimes that some of our State agencies are lobbying against these strong bills.

I would like to see the enforcement put in the hands of the people and in the local control area. I think we know our problem better, and I think we can attack it better.

I still feel there is a need for a State control to oversee and the Federal control to oversee our State.

Now, you will probably hear later on from our State agency some of the rhetoric which I addressed myself to earlier about how things are getting better and progress is being made. And, gentlemen, I plead with you to listen with a deaf ear. This is hogwash. I live in this area. I see it. We live in pollution 24 hours a day, 7 days a week, 365 days a year. We can tell.

All you need is an eye to see and nose to smell. One of my colleagues said sometimes it is so thick you can step in it.

You really are as far as I am concerned our last hope. It is my hope and the people that I represent that you will not take this soft touch, that you will come in and not waste too much time studying. Enough of those studies have been made. We know we have pollution. You know we have pollution. It is time for enforcement, and I guess the word today is "sock it to 'em."

Thank you.

(Applause.)

CHAIRMAN STEIN: Thank you.

MR. BRAUN: If there is a question I will try to answer.

CHAIRMAN STEIN: Are there any comments or questions? (No response.) I would say, Representative Braun, that we have been in many similar situations in the country and I indicated some other shellfish cases that we have had. For example, on Long Island the oysters are beginning to come back there, and Penobscot Bay in Maine the clams are beginning to come back.

I think I recognize a lot of the industry friends in the audience whom we have met in other parts of the country, and they know I think when we get into a case like this that we recognize and fully support the primary rights and responsibilities of the States in these matters.

We are here, and our operation is inexorable, and we are going to be firm. We may have a soft touch, but the way I look at it is that we are firm but fair.

But if there is pollution here, as far as I know, Mr. Quarles and all of us are dedicated to cleaning it up.

Thank you.

MR. BRAUN: Thank you.

CHAIRMAN STEIN: Thank you very much.

MR. BRAUN: I would like to answer that. I feel that many responsible industries and municipalities have made progress, but the problem lies with this same reckless, callous, renegade minority group whom I hope you will take in hand.

CHAIRMAN STEIN: Thank you.

Because of other engagements, Mr. Yantis has I believe someone he wants to put on now.

MR. YANTIS: I have just had a note from the gentleman that I was going to introduce which says he would like to wait a few moments before he speaks. So you will have to go on.

CHAIRMAN STEIN: Mr. Yantis, we are going to have to have I think the presentation by Mr. Gallagher, which may take an hour and a half. I wonder then, to schedule the rest of the morning, if he will be prepared to speak in about ten minutes?

MR. YANTIS: No.

CHAIRMAN STEIN: In that case, we will call on the Federal representative, Mr. Vanderhoof. Will you go ahead?

MR. RICHARD VANDERHOOF
CHIEF ENFORCEMENT OFFICER - REGION VI
ENVIRONMENTAL PROTECTION AGENCY
REGION VI
DALLAS, TEXAS

MR. VANDERHOOF: Thank you, Mr. Chairman. I am pleased to be a participant at this conference.

The Galveston Bay is a very important segment of the State of Texas as well as the United States, and it is increasing rapidly in growth in both population and in industrial might, and the amount of growth is staggering to the imagination.

R. Vanderhoof

It is a dynamic area. Now many people in this area have played a great part in its dynamic growth and are just as determined to clean up the pollution as they were in helping meet one of our Nation's goals during the past decade of placing a man on the moon.

Now another important goal has been set, and that is the movement to attain a pollution-free environment. We have the technology to meet that goal.

For example, in the arid region of Southwest Africa, the city of Windhoek is deliberately using its treated waste as a source of municipal water supply. This is deliberate reuse for municipal purposes.

As I have pointed out, the people of this area are making important contributions to our city, and I know that the leadership that is here and that has helped place this man on the moon -- men on the moon now -- will also want to assume the same degree of leadership in cleaning up this area.

Mr. Chairman, with your permission, I would like to take a moment and introduce some Regional Environmental Protection Agency personnel.

Mr. Bill McFarland, the Interim Regional Coordinator at Dallas.

Mr. Tom Harrison, the Regional Enforcement Officer; Mr. Malcolm Kallus in charge of our Houston office. Mr. Richard Duty in charge of our technical programs; Mr. Kenton Kirkpatrick in charge of the planning in the past and now the Acting Deputy Director; Mr. George Putnicki, our Research and Development Officer; and Mr. Jerry Thornhill who will talk later on Federal Activities.

CHAIRMAN STEIN: I believe Mr. Vanderhoff is going to call on the people for the Federal presentation, and we anticipate that this will take the rest of the morning.

I guess you have exposed us to your handsome and energetic staff. Since you have done that we are going to have to move forward. But we will take a recess now for ten minutes. Please be back promptly.

(Whereupon a short recess was taken.)

CHAIRMAN STEIN: Let's reconvene. Please take your seats. We have a very long program.

Mr. Vanderhoof.

MR. VANDERHOOF: Thank you, Mr. Chairman.

Our first witness will describe the existing situation. He will orient you as to facilities in this area.

Mal Kallus.

Mr. Kallus?

MR. MALCOLM KALLUS
CHIEF, GALVESTON BAY FIELD STATION
ENVIRONMENTAL PROTECTION AGENCY
WATER QUALITY PROGRAM
HOUSTON, TEXAS

MR. KALLUS: Thank you, Mr. Vanderhoof.

For the record, my name is Malcolm F. Kallus. I am Chief of the Galveston Bay Field Station, EPA Water Quality Program.

I would like to take a few brief moments to orient the conferees to the area under consideration and also to describe briefly some of the major pollution sources around the bay. These will be discussed in great detail by Mr. Gallagher in the next presentation.

The Galveston Bay system contains about 533 square miles of surface area and is the largest of the shallow bay systems behind the barrier islands along the Texas coast. It consists of Galveston Bay, Trinity Bay, East Bay, West Bay and numerous smaller arms called bays and lakes. The drainage area of the entire system is some 24,300 square miles. Major sources of freshwater inflow are the Trinity River, draining 17,800 square miles; the San Jacinto River, draining 3,900 square miles, and several smaller coastal streams draining some 2,500 square miles in aggregate.

Because of main stem impoundments on the Trinity and San Jacinto Rivers, the ecology of the bay is influcenced primarily by inflows from the immediate 3,600-square-mile drainage area. This area includes 600 square miles of the lower Trinity River Basin, 1,500 square miles of the lower San Jacinto River Basin and 1,500 square miles of directly draining creeks and bayous.

The waters of the Galveston Bay system are used extensively for recreation, propagation of fish and wildlife, industrial cooling water supply, navigation, aesthetics and waste disposal. Galveston Bay is the final receiving water prior to the Gulf of Mexico of drainage from the most highly developed complex metropolitan area of Texas. This drainage comprises municipal, industrial and agricultural wastes from Harris, Galveston and Chambers Counties and portions of Brazoria, Fort Bend, Liberty, and Montgomery Counties. These wastewaters include the effluents of about 270 municipal sources with secondary treatment and 460 industrial sources which vary from highly treated to raw.

The largest single source of wastes entering Galveston Bay is the Houston Ship Channel, which has been described by some as one of the most polluted streams in the United States. This channel which has made the Port of Houston the third largest in the Nation has also resulted in a 25-mile waterway, which, along the upper 15 miles of its length, is usually devoid of oxygen, and associated offensive odors and appearances persist. Upstream rainfall on Buffalo Bayou, the source stream of the upper Houston Ship Channel, causes flushing of channel wastes into Galveston Bay. Fish kills in side bays near the mouth of the inland portion of the channel at Morgan's Point are one result of this flushing. Another result is a myriad of refractory organic pollutants swept into Galveston Bay.

The city of Houston operates some 37 sewage treatment plants. The two largest, Northside and Sims Bayou discharge excess solids and inadequately-treated wastes into the Houston Ship Channel. Sludge banks, noxious bottom gases and totally anaerobic conditions are in evidence in the vicinity of both of these plants.

At the mouth of the present inland channel the Port of Houston is planning a major "second" port facility and industrial park. The location of this port is on a channel known as Barbours Cut which is planned to be enlarged. Such a development unless carefully planned will result in further degradation of Galveston Bay.

M. Kallus

The Houston Lighting & Power Company has under construction on Cedar Bayou a thermal electric generating plant which when completed will have a capacity of 5,000 megawatts. The first unit with a 750 megawatt capacity is currently in operation and a second 750 megawatt unit is nearing completion. This plant as now designed utilizes once-through cooling water taken in from Galveston Bay in the vicinity of the mouth of the Houston Ship Channel via a flow reversal in Cedar Bayou, and after heating is discharged into Trinity Bay through a 6-mile discharge canal. When fully developed, the discharge of 5,000 c.f.s. of heated water by this plant will completely dominate the circulation patterns in Trinity Bay. The freshwater inflows to the Galveston Bay System during the low-flow summer conditions are less than 3,000 c.f.s.*

One of the prime customers for this electric power is U. S. Steel, which has under construction a fully integrated steel mill expected to ultimately discharge over 250 MGD of blowdown water from a recirculated freshwater system. The Freshwater for this plant is to be supplied by the Coastal Industrial Water Authority through a canal which siphons under the Houston Lighting & Power Company's discharge canal.

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*TRACOR, Water Quality Analysis of the Cedar Bayou Generating Stations, prepared for Houston Lighting & Power Company, July 1, 1970.

The major source of freshwater to the system, the Trinity River, is being damned at its mouth by the Corps of Engineers. In the process more than 12,000 acres of productive marshland are being inundated, and consumptive water use of impounded water will reduce freshwater inflows, jeopardizing the nursery areas for the most productive and commercially valuable bay on the Texas coast.

The Bayport Industrial Complex complete with a planned deepwater port facility has begun operation south of La Porte. This complex of petrochemical and chemical plants utilizes a single waste treatment plant operated by Friendswood Development Company.

Clear Lake, a hydrologically insignificant but economically important tributary to Galveston Bay, is experiencing advanced eutrophication caused by rapid growth during the past decade associated with the NASA Manned Spacecraft Center and poor treatment of municipal wastes complicated by an unfavorable hydrology.

Approved water quality standards require diversion of all sewage effluents from the watershed. However, the Texas Water Quality Board has approved an alternative of advanced waste treatment.

The Texas City industrial complex is another area of industrial waste discharge to Galveston Bay. There are 17 waste sources in this area, 11 of which are petroleum related and account for 99 percent of the wastes.

The city of Galveston, which depends largely on tourism for its existence, is operating a grossly overloaded waste treatment plant alongside a garbage dump which is encroaching on bay waters.

This completes my presentation of a brief tour around the bay and the major pollution sources.

MR. VANDERHOOF: Thank you, Mr. Kallus.

This is all one presentation. The second part of it will be by Mr. Tom Gallagher.

MR. THOMAS P. GALLAGHER
DIRECTOR, FIELD INVESTIGATION
DENVER OFFICE OF ENFORCEMENT
REGION VIII
ENVIRONMENTAL PROTECTION AGENCY
DENVER, COLORADO

MR. GALLAGHER: Mr. Chairman, conferees, my name is Thomas P. Gallagher. I am Director of Field Investigation for the Denver Office of Enforcement of the Environmental Protection Agency.

I will present a report entitled "Pollution Affecting Shellfish Harvesting in Galveston Bay, Texas." I would like the entire report to be entered into the record as if read.*

CHAIRMAN STEIN: Without objection, this will be done.

MR. GALLAGHER: Thank you, Mr. Stein.

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*See page 145.

T. P. Gallagher

I. INTRODUCTION

Water quality standards were adopted for Galveston Bay and its tributaries by the Texas Water Quality Board in June 1967 and accepted by the Secretary of the Interior on January 28, 1968, in accordance with the Federal Water Quality Act of 1965. Pollution of these waters is subject to the provisions of Section 10, Federal Water Pollution Control Act, as amended. Section 10(a) of the Act provides that the pollution of navigable waters in or adjacent to any State, which endangers the health or welfare of any persons, shall be subject to abatement.

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This presentation summarizes presently available information pertaining to the quality of the Galveston Bay system; evaluates that information with respect to applicable standards, statutes, regulations and criteria; and recommends a program which will lead to compliance with established water quality uses.

Sources of information contained in this report include: The National Estuarine Pollution Study, FWQA; the Texas Water Quality Board; the Texas Parks and Wildlife Department; the Texas State Department of Health; the Texas Water Development Board; the Galveston Bay Study (a cooperative Federal-State-local study currently in progress); Texas A & M University and the U. S. Army Corps of Engineers. Limited field studies were also conducted by the Division of Field Investigations, Denver Center, WQO-EPA, to obtain additional data. The cooperation and contribution of the various State, local and private organizations are gratefully appreciated.

CHAIRMAN STEIN: Mr. Gallagher, while you are switching to another section of the report, I would like to indicate we do have a call board for messages at the registration desk.

I guess I am lucky I brought my boss along and he knows where I am. But I understand that a lot of the company officials are getting calls, and you may wish to check on your way out if you feel you are going to get a call.

Mr. Gallagher, would you continue?

(Whereupon Mr. Gallagher read the remainder of the Federal report in its entirety as follows.)

ENVIRONMENTAL PROTECTION AGENCY
WATER QUALITY OFFICE

145

REPORT ON

POLLUTION AFFECTING SHELLFISH HARVESTING in GALVESTON BAY, TEXAS

PREPARED BY

DIVISION OF FIELD INVESTIGATIONS - DENVER CENTER

AND

SOUTH CENTRAL REGION

DENVER, COLORADO
DALLAS, TEXAS

MARCH 1971

ENVIRONMENTAL PROTECTION AGENCY

WATER QUALITY OFFICE

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March 1971

TABLE OF CONTENTS

Section	Title	Page
	LIST OF FIGURES	iii
	LIST OF TABLES	v
I	INTRODUCTION	1
II	SUMMARY AND CONCLUSIONS	3
III	RECOMMENDATIONS	11
IV	DESCRIPTION OF AREA	15
	A. PHYSICAL DESCRIPTION	15
	B. CLIMATE	16
	C. HYDROLOGY	17
	D. POPULATION	19
	E. ECONOMY	20
	F. WATER USE	21
	Municipal and Industrial Water Supply	21
	Navigation	23
	Recreation	24
	Irrigation	25
	Shellfish Harvesting	25
V	WATER QUALITY	29
	A. APPLICABLE STANDARDS	29
	B. COLIFORM	31
	C. HEAVY METALS AND PESTICIDES	36
	D. OIL AND PETROCHEMICAL RESIDUES	40
	E. DISSOLVED OXYGEN	44
	F. BIOCHEMICAL OXYGEN DEMAND	47
VI	WASTE SOURCES	51
	A. MUNICIPAL AND DOMESTIC WASTE DISCHARGES	64
	B. INDUSTRIAL WASTE DISCHARGES	65
	C. OTHER SOURCES	75
VII	ECONOMIC IMPACT OF POLLUTION	79
	A. SHELLFISH AREAS CLOSED BY POLLUTION	79
	B. PRODUCTIVE SHELLFISH BEDS IN CLOSED AREAS	81
	C. ECONOMIC DAMAGES	83

TABLE OF CONTENTS (CONT'D)

Section	Title	Page
VIII	WATER QUALITY IMPACT OF FUTURE DEVELOPMENTS . . .	87
	A. HOUSTON WATER SUPPLY DIVERSION	87
	B. CEDAR BAYOU POWER PLANT	90
	C. MORGAN POINT DEEPWATER PORT	95
	BIBLIOGRAPHY	97
	APPENDICES	
	A APPLICABLE TEXAS WATER QUALITY REQUIREMENTS FOR THE GALVESTON BAY AREA AND THE PUBLIC HEALTH SERVICE MANUAL "SANITATION OF SHELLFISH GROWING AREAS"	
	B ODOR EVALUATION TEST PROCEDURES AND RESULTS	

LIST OF FIGURES

Figure No.	Title	Page
IV-1	Galveston Bay Area	Follows Page 16
V-1	Water Quality Standards Zones in the Galveston Bay Area	Follows Page 30
V-2	Galveston Bay Study Sampling Stations and Classifications of Shellfish Harvesting Areas	Follows Page 32
V-3	Isolines of Median Coliform Concentrations, Galveston Bay	Follows Page 34
V-4	Percent of Samples with Total Coliform Concentrations Greater Than 230/100 ml, Galveston Bay	Follows Page 34
V-5	Isolines of Total Coliform Concentrations - Galveston Bay - January 14, 1969	Follows Page 34
V-6	Isolines of Total Coliform Concentrations - Galveston Bay - February 18, 1969	Follows Page 34
V-7	Isolines of Total Coliform Concentrations - Galveston Bay - March 18, 1969	Follows Page 34
V-8	Isolines of Total Coliform Concentrations - Galveston Bay - January 13, 1970	Follows Page 34
V-9	Isolines of Total Coliform Concentrations - Galveston Bay - February 10, 1970	Follows Page 34
V-10	Isolines of Total Coliform Concentrations - Galveston Bay - March 10, 1970	Follows Page 34
V-11	Water and Oyster Sampling Locations -- FWQA Reconnaissance Survey, November 1970	Follows Page 46

LIST OF FIGURES (CONT'D)

Figure No.	Title	Page
VI-1	Permitted Wastewater Discharges in the Galveston Bay Area	Follows Page 64
VI-2	Permitted Suspended Solids Discharges in Galveston Bay Area	Follows Page 64
VI-3	Permitted BOD Waste Discharges in the Galveston Bay Area	Follows Page 64
VI-4	Permitted COD Waste Discharges in the Galveston Bay Area	Follows Page 64
VII-1	Classifications of Shellfish Harvesting Areas	Follows Page 80
VIII-1	Future Development	Follows Page 90

LIST OF TABLES

Table No.	Title	Page
IV-1	Municipal and Industrial Uses of Water in the Vicinity of Galveston Bay 1960, and Projected 1990 and 2020	22
IV-2	Oyster Harvest and Value, Galveston Bay	26
V-1	Summary of Texas Water Quality Standards Applicable to Galveston Bay and Houston Ship Channel	30
V-2	Median Values of Total Coliform Concentrations and Percentage of Samples Greater Than 230 Coliform/100 ml at Selected Stations in Galveston Bay for Periods Dec.1968-April 1969 and Dec.1969-April 1970	32
V-3	Median Fecal Coliform Concentrations and Percentage of Samples with Fecal Coliform Concentrations Greater than 33/100 ml at Selected Stations in Galveston Bay for the Periods Dec.1968-April 1969 and Dec.1969-April 1970	34
V-4	Concentrations of Heavy Metals Galveston Bay - Houston Ship Channel	38
V-5	Metals Concentrations in Oysters from Galveston Bay November 12, 1970	41
V-6	Evaluation of Galveston Bay Oyster Meats for Odor	45
V-7	Comparison of BOD Standards with Observed and Average Values	49
VI-1-A	Municipal and Domestic Waste Discharges to the Houston Ship Channel above Morgan Point, Including Baytown Area	52
VI-1-B	Municipal and Domestic Waste Discharges to Galveston Bay	56

LIST OF TABLES (CONT'D.)

Table No.	Title	Page
VI-2-A	Waste Discharges from Petroleum, Chemical, Plastics, and Rubber Industries to the Houston Ship Channel or Its Tributaries Above Morgan Point Including the Baytown Area	58
VI-2-B	Other Industrial Discharges to the Houston Ship Channel or Its Tributaries	60
VI-2-C	Waste Discharges from Petroleum, Chemical, Plastics, and Rubber Industries to Galveston Bay or Its Tributaries	62
VI-2-D	Other Industrial Discharges to Galveston Bay or Its Tributaries	63
VI-3	Pollutants Associated with Various Petrochemical Processes	72
VI-4	Discharges of Heavy Metals to the Houston Ship Channel	74
VI-5	Summary of Permitted Waste Discharges, Galveston Bay Area	76

I. INTRODUCTION

Water quality standards were adopted for Galveston Bay and its tributaries by the Texas Water Quality Board in June 1967 and accepted by the Secretary of the Interior on January 28, 1968 in accordance with the Federal Water Quality Act of 1965. Pollution of these waters is subject to the provisions of Section 10, Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.). Section 10(a) of the Act provides that the pollution of navigable waters in or adjacent to any State, which endangers the health or welfare of any persons, shall be subject to abatement.

Section 10(d) of the Act further provides that a Federal-State conference shall be called whenever, on the basis of reports, surveys, or studies, there is reason to believe that substantial economic injury results from the inability to market shellfish or shellfish products in interstate commerce because of pollution of such waters, and because of action of Federal, State or local authorities.

This report summarizes presently available information pertaining to the quality of the Galveston Bay system; evaluates that information with respect to applicable standards, statutes, regulations, and criteria; and recommends a program which will lead to compliance with established water quality uses.

Specific objectives of the report are:

(1) To describe existing water quality in the Galveston Bay system.

(2) To summarize presently available information pertaining to sources of pollution.

(3) To evaluate the impact of present waste discharges on water quality and uses, and to assess compliance with established State and Federal regulations.

(4) To indicate the effect of projected water related development upon water quality in the Galveston Bay system.

Sources of information contained in this report include: the National Estuarine Pollution Study, FWQA; the Texas Water Quality Board; the Texas Parks and Wildlife Department; the Texas State Department of Health; the Texas Water Development Board; the Galveston Bay Study (a cooperative Federal-State-local study currently in progress), Texas A&M University and the U.S. Army Corps of Engineers. Limited field studies were also conducted by the Division of Field Investigations, Denver Center, WQO - EPA, to obtain additional data. The cooperation and contribution of the various State, local and private organizations are gratefully appreciated.

II. SUMMARY AND CONCLUSIONS

The area considered in this report includes all of Galveston Bay, Texas, and its major tributary streams and embayments.

Nearly half of Galveston Bay is presently closed for shellfish harvesting due to excessive bacteriological contamination and the proximity to sewage and industrial waste effluents. Total coliform concentrations at two locations in the approved area of Galveston Bay and one location in the approved area of West Bay exceed the applicable criteria of 230 organisms per 100 milliliters more than 10 percent of the time (Appendix B), based on monthly samples collected by the Galveston Bay Study during the 1968-69 and 1969-70 shellfish harvesting seasons.

Under the applicable standards for shellfish harvesting, sampling to determine approved and prohibited areas must be conducted under the most unfavorable hydrographic and pollution conditions. In Galveston Bay, the most unfavorable hydrographic and pollution conditions occur with northerly and northwesterly winds as well as precipitation. During the 1968-69 shellfish harvesting season, these conditions occurred about 40 percent of the time. On days when the most unfavorable hydrographic and pollution conditions occur, virtually the entire approved area in Galveston Bay, including the most productive reefs, have total coliform concentrations exceeding the required criteria. If sampling were regularly conducted under these conditions, nearly all of Galveston Bay would be closed to shellfish harvesting due to excessive bacteriological pollution.

The major source of bacteriological pollution to both open and closed areas for shellfish harvesting in Galveston Bay is the Houston Ship Channel. The Clear Lake area also contributed to excessive total coliform concentrations in the Bay. The City of Galveston area, while not affecting concentrations in approved areas, does discharge significant bacteriological pollution to the closed areas. There are localized influences of bacteriological pollution in West Bay approved areas from Chocolate Bayou and in Galveston Bay proper from Double Bayou.

Of the more than 215 million gallons per day (MGD) of domestic waste which are permitted by the Texas Water Quality Board to be discharged to Galveston Bay and its tributaries, about 110 MGD is raw, inadequately treated and/or unchlorinated. As of January 1971, the two largest sewage treatment plants of the City of Houston which discharge to the Ship Channel area, the Northside and Sims Bayou plants, account for 103 MGD of unchlorinated discharge. The effluent from each of these plants contained nearly 35,000,000 total coliform organisms per 100 milliliters during February 1969 sampling.

Oil and hydrocarbon residues were observed in oysters taken from both approved and prohibited areas of Galveston Bay, ranging from 23 parts per million (ppm) and 26 ppm in the approved area to 237 ppm in a prohibited area near the mouth of the Houston Ship

Channel. These hydrocarbons are not generated by the oysters themselves but derived from petroleum wastes. The concentrations observed in oysters taken from approved areas in Galveston Bay are from two to six times greater than concentrations in oysters from West Falmouth Bay, Massachusetts. The State of Massachusetts closed West Falmouth Harbor to shellfish harvesting, based on residues in oyster tissue ranging between 4.0 ppm and 12.0 ppm. Odor tests on Galveston Bay oysters showed unacceptable concentrations of odor-causing materials in all samples from both approved and prohibited harvesting areas. The intensity of odor became less as distance from the Houston Ship Channel increased. There is a health hazard, in addition to bacteriological pollution, associated with consumption of Galveston Bay oysters due to the presence of oil and hydrocarbon residues in excessive concentrations.

According to 1968 Texas Water Quality Board permits, there are 75 sources of petroleum refining or related industrial effluents in the Galveston Bay area. These effluents constitute a permitted discharge of nearly 423 MGD with a total of 1,144,000 pounds per day of chemical oxygen demand. The permits allow the discharge of more than 55,000 pounds per day of oil and grease from 81 sources, although this is in direct violation of Section 11-b of the Federal Water Pollution Control Act as amended. The Texas Water Quality Requirements specify that receiving waters shall be "substantially free" of oil. Seventy-four of these sources are located on the Houston Ship Channel, accounting for 98 percent of the total permitted discharge. The major industries permitted to discharge oil and grease are: Diamond Shamrock Corporation at Deer Park, U. S. Plywood-Champion Paper Company, Armco Steel Company, Atlantic Richfield Company, Humble Oil and Refining Company, Southland Paper Mills, Shell Chemical Company, and Crown Central Petroleum Company. These eight sources account for 86 percent of the permitted discharges.

It is estimated that 1,600 pounds per day of lead, 5,000 pounds per day of cadmium, 400 pounds per day of phenols, 7,900 pounds per day of zinc, 300 pounds per day of chromium and at least 1,000 pounds per day of cyanide are discharged, primarily to the Houston Ship Channel. Concentrations of these heavy metals and toxic compounds in the waters of Galveston Bay and the Houston Ship Channel range from 8.5 times greater than background in natural seawater for nickel, to 108,000 times greater than background for chromium. These concentrations indicate substantial contamination of the receiving waters by waste discharges. Concentrations of toxic compounds in the Houston Ship Channel are three times greater than levels which could be tolerated for normal algal growth. The known major dischargers of heavy metals contamination are Diamond Shamrock Company, Armco Steel Company, Olin Mathieson Corporation, Houston Northside sewage treatment plant, U. S. Plywood-Champion Paper Company, Humble Oil and Refining Company (Baytown), and Shell Chemical Company (Deer Park). These sources discharge more than

500 pounds per day as determined by sampling conducted by the Texas Water Quality Board in February 1969. Although the health hazard and specific numerical criteria associated with concentrations of heavy metals and toxic substances has not been established by the appropriate regulatory agencies, the Texas Water Quality Requirements prohibit acute or chronic toxicity to human, animal, or aquatic life.

Dissolved oxygen and biochemical oxygen demand (BOD) criteria established by the State of Texas for the Houston Ship Channel are almost continually violated due to the discharge of municipal and industrial wastes. Although the Texas Water Quality Board permits specify that 180,800 pounds per day of BOD may be discharged from municipal and industrial sources to the Houston Ship Channel, studies conducted in the Channel during 1968 and 1969 indicate that as much as 363,000 pounds per day of five-day BOD is the actual loading. The aggregate total of waste discharges to the Ship Channel is in substantial non-compliance with the Texas Water Quality Board permits.

The 1968 permits allow the discharge of 315,000 pounds per day of suspended solids to the Houston Ship Channel. Bottom material dredged from the Ship Channel contains substantial quantities of organic sludges, oil and other pollutants characteristic of wastes discharged to the Channel. About one-third of the BOD loading and one-half of the suspended solids discharged from waste sources settle out and are incorporated in the bottom sediments. These waste materials contribute a substantial portion of the sediments which must periodically be removed by dredging. The total project cost incurred by the U.S. Army Corps of Engineers for dredging the Houston Ship Channel in 1970 is $2,807,000. The disposal of this highly organic spoil may cause water quality problems through dispersion of pollutants and through exercise of oxygen demand from the volatile material contained.

The total permitted discharge of waste effluent to Galveston Bay and its tributaries is approximately 779 MGD which may contain 583,000 pounds per day of suspended solids, 270,000 pounds per day of BOD and 1,657,000 pounds per day of chemical oxygen demand (COD). Of this total, 92.6 percent of the suspended solids, 85.5 percent of the BOD and 92.8 percent of the COD are allocated to industrial sources. Industrial sources contribute about 72 percent of the total waste flow.

Of the 277 municipal and industrial waste sources having discharge permits in the Galveston Bay area, the waste treatment needs and status of 189 are not listed. Where needs are indicated, 40 sources provide inadequate or no treatment and no abatement, beyond engineering studies in a few instances, is in progress. Seventeen sources have treatment facilities in progress; 22 are said to be in compliance with permit requirements. Nine sources either provide adequate treatment or have no needs.

The City of Houston discharges wastes from 41 treatment plants, only eight of which have flows greater than 1 MGD. Harris County sewer districts discharge wastes from 27 sources, only one of which has a flow of 1 MGD. Galveston has three sources and Baytown has five. The multiplicity of waste treatment plants does not provide adequate operations to assure the best treatment of domestic sewage.

The development of an electrical power plant at Cedar Bayou by the Houston Lighting and Power Company will eventually require about 5,000 cubic feet per second (cfs) of cooling water. Some of the intake cooling water will consist of grossly polluted water from the lower reaches of the Houston Ship Channel. The heated water will be discharged to the relatively unpolluted Trinity Bay. Water temperature in a large portion of Trinity Bay will be raised above background. Trinity Bay is the major spawning area for commerical shrimp in Galveston Bay.

The present actual economic loss to the Galveston Bay area caused by inability to market shellfish due to pollution ranges between $86,000 and $258,000 annually at dockside. If excessive hydrocarbon or heavy metals concentrations in oysters and/or sampling under the most unfavorable hydrographic and pollution conditions, as required, caused the closure of all Galveston Bay to shellfish harvesting, the potential damage would be substantially greater. The final retail value of shellfish products is roughly four times the dockside value. The total actual damages caused by pollution affecting shellfish harvesting in Galveston Bay are between $359,000 and $1,045,000 annually.

Sewage and industrial wastes discharged to Galveston Bay and its tributaries are causing substantial economic injury resulting from the inability to market shellfish or shellfish products in interstate commerce. Accordingly, the pollution of these navigable waters is subject to abatement under the provisions of Section 10 of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1151 et seq.).

III. RECOMMENDATIONS

To eliminate the health hazard associated with consumption of shellfish from the Galveston Bay system and to abate the existing pollution, it is recommended that:

1) Due to concentrations of oil and hydrocarbon residues in oysters taken from approved areas in Galveston Bay, the Texas State Department of Health, in cooperation with the Food and Drug Administration, ascertain the extent of health hazard incurred, and, if warranted, recommend closure of Galveston Bay to shellfish harvesting. Consideration be given to prohibition of all commercial fishing in Galveston Bay until it has been ascertained that the marine species taken from the Bay are suitable for human consumption

2) Sampling for determining bacteriological acceptability of areas for shellfish harvesting in Galveston Bay be conducted under the most unfavorable hydrographic and pollution conditions as required by applicable regulations. The most unfavorable hydrographic and pollution conditions occur with northerly and/or northwesterly winds during or following periods of precipitation.

3) Effective disinfection of all waste sources contributing bacteriological pollution to Galveston Bay be provided. A program of centralization and abandonment of small plants be undertaken to assure the best treatment for domestic sewage, with an implementation schedule to be submitted to the Conferees within three months of the date of the first session of the Galveston Bay Enforcement Conference.

4) A waste source survey be conducted on all sources of domestic and industrial waste permitted by the Texas Water Quality Board to discharge effluent to Galveston Bay and its tributaries. This survey should characterize and quantify specific compounds being discharged and include recommendations and scheduling of abatement measures. A characterization and scheduling of abatement for the 55 waste sources discharging more than 500,000 gallons per day be submitted to the Conferees within eight months of the date of the first session of the Galveston Bay Enforcement Conference. The Texas Water Quality Board permits be amended to reflect the recommendations of this waste source survey including the compliance schedule.

5) The Texas Water Quality Board permits be amended to immediately prohibit the discharge of oil and grease as well as toxic materials from all waste sources.

6) The additional costs incurred by the Corps of Engineers for dredging of the Houston Ship Channel and the effect on water quality due to disposal of the organic sludge be evaluated. Recommendations of this evaluation include an assessment of damages among the waste dischargers to the Channel and, location of suitable spoil disposal areas to minimize or eliminate deleterious effects on water quality.

7) The Houston Lighting and Power Company be required to abate the waste heat load to be discharged from the Cedar Bayou

plant to Trinity Bay such that the monthly mean of the maximum daily temperatures not be raised more than 4°F during the fall, winter and spring (September through May), or by more than 1.5°F during the summer (June through August) at the point of discharge. A cooling system incorporating recirculation and reuse be installed at the Cedar Bayou power plant. The Houston Lighting and Power Company also insure that no deleterious effects or impairment of water quality occur in Trinity Bay by reason of the use of a polluted source for cooling water.

8) A committee be appointed to make recommendations to the Secretary of Health, Education, and Welfare and the Administrator of the Environmental Protection Agency within one year from the date of establishment, on interim specific numerical criteria in both water and meat for acceptance of shellfish and other commercially valuable species taken from Galveston Bay. The specific numerical criteria to include bacteriological, oil and hydrocarbon residue, taste and odor, as well as other acute and chronically toxic or growth-inhibiting parameters. The committee include representatives of the Food and Drug Administration and the Environmental Protection Agency, in cooperation with appropriate Texas regulatory agencies.

9) Color of the waste effluent from U.S. Plywood-Champion Paper Company and Southland Paper Mills be reduced to natural background occurring in uncontaminated area waters.

10) An assessment be made of the total waste load which can be discharged to Galveston Bay and/or its tributaries to meet applicable State and Federal water quality standards as well as the recommendations of this report. This waste load be allocated among individual waste dischargers and not be exceeded regardless of future development.

IV. DESCRIPTION OF AREA

A. PHYSICAL DESCRIPTION

Galveston Bay is located in southeastern Texas on the Gulf of Mexico about 25 miles southeast of Houston, the largest city in the State. The Galveston Bay estuarine system, consisting of four large bays, Galveston, Trinity, East, and West Bays, and numerous smaller bays, creeks and bayous, has a total surface area of about 533 square miles and is the largest estuary on the Texas coast. The combined shoreline totals 245 miles.

The major bays are broad and shallow, averaging less than ten feet in depth. The smaller bays, creeks and bayous are shallow and sluggish. Marshes border the open water in many areas.

Most of the land surface adjacent to the bay system is only a few feet above sea level and is virtually flat for about 50 miles inland from the Gulf of Mexico. The natural drainage is poorly defined and has been altered by irrigation, drainage canals, and other man-made waterways.

Impoundments on the Trinity and San Jacinto Rivers regulate fresh water inflows from these streams. As a result, the hydrology of the estuary is influenced primarily by inflows from an area of 3,600 square miles in the immediate vicinity. The area includes 600 square miles of the lower Trinity River Basin, 1,500 square miles of the lower San Jacinto River Basin, and 1,500 square miles which drain directly into the bay system through bayous and creeks. The total drainage area of Galveston Bay is 24,300 square miles of which 17,800 square miles is in the Trinity River system and 3,900 square miles in the San Jacinto system. The remaining 2,500 square miles is from numerous small streams draining to the bay.

Three major passages connect the estuary with the Gulf of Mexico. San Luis Pass and Rollover Pass, an artificial fish passage, are outlets for West and East Bays, respectively. The largest passage is Bolivar Roads, located between Galveston Island and Bolivar Peninsula. This openeing is the primary outlet for the estuarine system.

Several navigation channels are located in the estuary. Of major importance is the Houston Ship Channel, a dredged deep-draft channel which enters Bolivar Roads, traverses Galveston Bay, the San Jacinto River and Buffalo Bayou, and terminates in Houston about 50 miles from the Gulf of Mexico. Shorter deep-draft channels connect port facilities in Galveston and Texas City with the shallow-draft Intracoastal Waterway which traverses East and West Bays. Other shallow waterways connect various points in the estuary system. The area under consideration is illustrated in Figure IV-1.

B. CLIMATE

The average annual rainfall in the Houston area is approximately 45 inches per year, with monthly rainfall evenly distributed

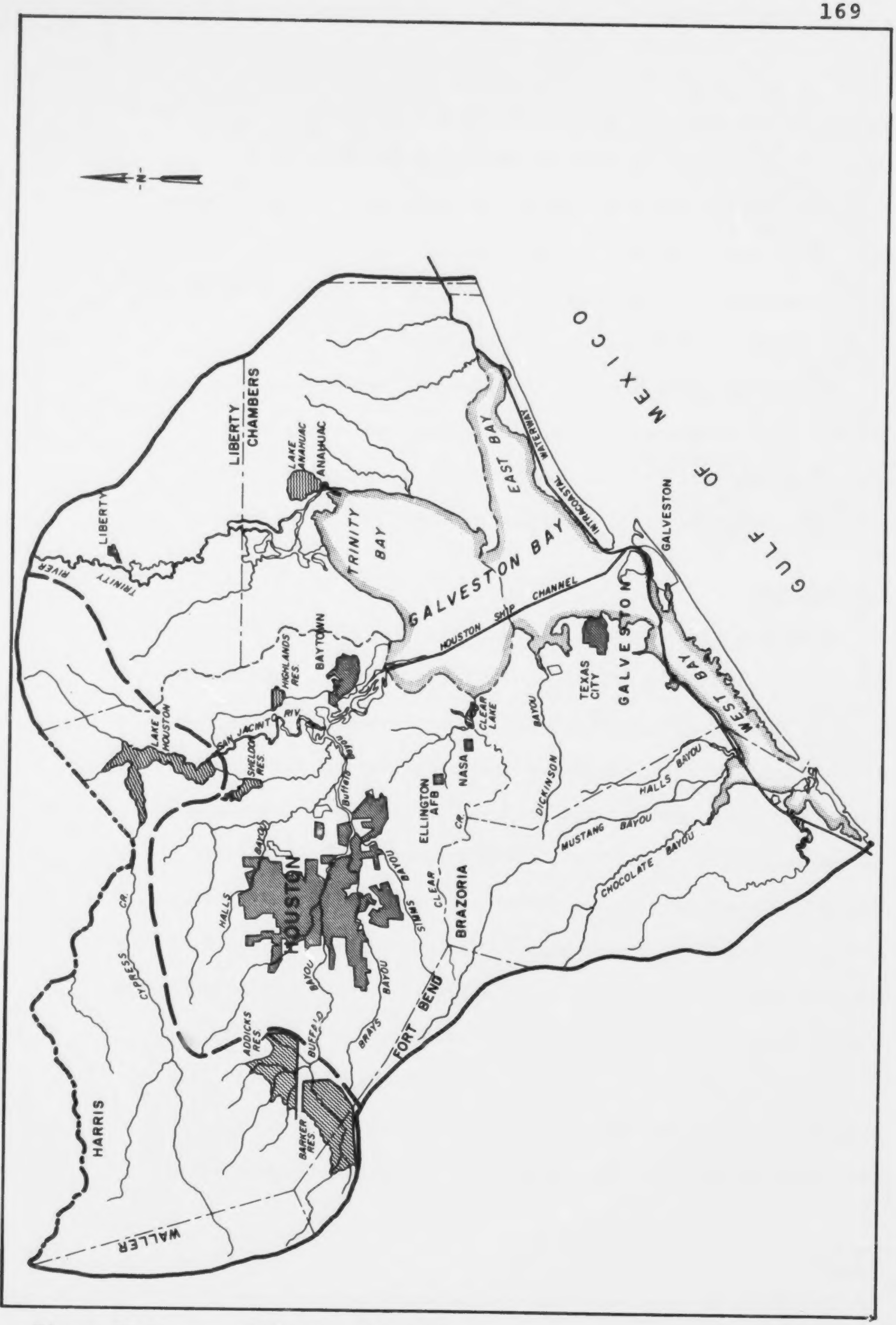

N
GULF OF MEXICO
GALVESTON BAY
TRINITY BAY
EAST BAY
WEST BAY
INTRACOASTAL WATERWAY
HOUSTON SHIP CHANNEL
GALVESTON
GALVESTON
TEXAS CITY
LIBERTY
LIBERTY
CHAMBERS
LAKE ANAHUAC
ANAHUAC
TRINITY RIVER
BAYTOWN
HIGHLANDS RES.
LAKE HOUSTON
SAN JACINTO RIV
SHELDON RES.
CLEAR LAKE
NASA
ELLINGTON AFB
CLEAR CR.
DICKINSON BAYOU
HALLS BAYOU
MUSTANG BAYOU
CHOCOLATE BAYOU
BRAZORIA
FORT BEND
HOUSTON
HALLS BAYOU
BUFFALO BAYOU
SIMMS BAYOU
BRAYS BAYOU
CYPRESS CR.
ADDICKS RES.
BARKER RES.
BUFFALO
HARRIS
WALLER

Figure IV-1 Galveston Bay Area

throughout the year. Thunderstorms are the main source of precipitation, with rainfall of several inches per day not uncommon.

Temperatures are moderated by the influence of winds from the Gulf, which result in mild winters and warm humid summers. Average daily temperatures range from about 53°F in the winter to about 83°F in the summer, with an annual mean temperature of 69°F.

Prevailing winds are from the southeast and south, except in January, when frequent passages of high pressure areas bring prevailing northerly winds. Thundersqualls and tropical storms with high wind velocities occasionally pass through the area.

C. HYDROLOGY

Freshwater inflow to the estuarine system from the Trinity and San Jacinto Rivers and other coastal streams averages about 11,300 cubic feet per second (cfs), or an average annual volume of 8.2 million acre-feet. Both the rate of inflow and the annual runoff fluctuate widely. For example, in 1965 the average weekly inflow varied from less than 1,000 cfs to more than 45,000 cfs. Between 1941 and 1957, total annual inflow varied from less than 2 million acre-feet to more than 20 million acre-feet. Precipitation falling directly on the water surface of the estuary contributes a fresh water inflow of about 1.4 million acre-feet annually.

The location, relative magnitude and variability of the major sources of freshwater exert a strong influence on water quality in the estuarine system. The Trinity and San Jacinto Rivers together contribute almost 90 percent of total freshwater inflow. With an average annual flow rate of 7,900 cubic feet per second, the Trinity River strongly influences salinity levels in Trinity Bay. The Houston Ship Channel traverses the lower ten miles of the San Jacinto River. High flows in the river thus tend to flush degraded water from the middle reach of the ship channel out into Galveston Bay. Buffalo Bayou, a small stream with a drainage area of about 360 square miles, discharges into the upper end of the ship channel in the City of Houston. Peak flows in the bayou following heavy rainfall frequently flush the water contained in the upper 25 miles of the ship channel, into Galveston Bay.

A major portion of the water supply for municipal and industrial purposes in the Galveston Bay area is obtained from groundwater sources. The principal freshwater aquifer in the area is the Gulf Coast Aquifer which has a saturated depth exceeding 3,000 feet. Recharge of the aquifer is adequate to sustain the present rate of pumping if the withdrawal points were adequately dispersed. Sustained heavy withdrawals in local areas have caused overdrafts of the aquifer. Declining water tables, land subsidence and salinity intrusion problems have resulted. A reduction in ground water withdrawals is expected in the future as these problems become more severe and alternate surface supplies become available.

Two types of tides occur in the Galveston Bay estuary during normal weather. Diurnal tides, with an average range of 1.25 feet, exist during two to three weeks per month, and semi-diurnal tides, with an average range of 0.5 feet, prevail during the remaining period. The complex geometry of the bay causes amplifications and reflections of normal tidal effects resulting in considerable spatial variation in tides. During unusual weather conditions, such as high winds or the passage of a cold front, the Galveston Bay tides become wind-dominated and no consistent tidal performance can be observed.

Current measurements made by the Corps of Engineers show that ebb and flood currents in the Houston Ship Channel are about 1.5 feet per second[1/]. In shallow areas of Galveston Bay, water currents average between 0.3 and 0.4 feet per second. However, in some of the passes and channels between reefs, currents may range as high as four feet per second.

D. POPULATION

The population of the Galveston Bay Basin, including three counties and portions of four additional counties, was estimated at 1.4 million in 1960. By 1968, the population had increased to an estimated 1.8 million. The Houston Standard Metropolitan Statistical Area (SMSA), with 1970 population of 1.9 million, and the Galveston-Texas City SMSA, with combined 1970 population of 178,000, are the most important urban areas.

[1/] Bobb, W. H., and R. A. Boland, Jr., Galveston Bay Hurricane Surge Study, Technical Report H-69-12, July 1970, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

The population of the area is expected to continue the rapid growth rate of recent years. Projections indicate that the population of the area will triple by the year 2020.

E. ECONOMY

The economy of the area rests heavily on manufacturing, chiefly in the petrochemical field. Manufacturing is concentrated around the southern and western shores of Galveston Bay, in the Houston metropolitan area, and along the Houston Ship Channel. This concentration is expected to become more pronounced as the potential development of the area is realized.

Since construction of the Houston Ship Channel in 1914, Houston has become a major port, now surpassed in total tonnages handled by only two other U.S. ports, New York and New Orleans. The requirement for sites located near the Texas oil fields and major shipping lanes has led to intensive development along the Ship Channel of refineries, chemical and petrochemical manufacturing plants. Fertilizer factories, gypsum and cement plants, two steel mills, paper manufacturing and other industrial facilities are also located adjacent or in close proximity to the Ship Channel.

Location of the National Aeronautics and Space Administration's Manned Spacecraft Center near Clear Lake on Galveston Bay has attracted associated components of the aerospace industry to the Houston metropolitan area and has helped to diversify the economy.

The service industries and local, State, and Federal government are presently the largest employers in the area. This category of employment along with employment by the trade industries is projected to substantially increase in the future relative to employment in manufacturing and other categories.

F. WATER USE

A variety of beneficial uses is made of the waters of the Galveston Bay estuarine system and tributary streams. The most important of these uses include municipal and industrial water supply, propagation of fish and wildlife, navigation, recreation, and irrigation. The rapidly expanding electrical power requirements for the Galveston Bay area are being paralleled by increased use of water for cooling purposes.

Municipal and Industrial Water Supply

Water use for municipal and industrial purposes other than condenser cooling water was estimated in 1960 to total about 608,000 acre-feet per year (544 million gallons per day-MGD) for the Galveston Bay area. Almost 80 percent of this water supply was obtained from groundwater, as shown in Table IV-1. The relative use of water at various locations in the area is also shown in the table. It is estimated that average annual water use will total about 1.7 million acre-feet (1,520 MGD) by 1990 and 3.3 million acre-feet (2,850 MGD) by 2020.

In 1968, nine public utility steam electric generating plants were operating in the vicinity of Galveston Bay. These plants have a production capacity of 3,632 megawatts and a peak demand

TABLE IV-1

MUNICIPAL AND INDUSTRIAL USES OF WATER IN THE VICINITY OF GALVESTON BAY 1960, AND PROJECTED 1990 AND 2020 (1,000 acre-feet per year)

Basin	Zone	1960			Projected 1990			Projected 2020		
		Ground	Surface	Total	Ground	Surface	Total	Ground	Surface	Total
Neches-Trinity Coastal	2	0.1	5.6	5.7	-	23.6	23.6	-	53.0	53.0
Trinity	3	24.3	-	24.3	48.8	18.6	67.4	49.1	92.3	141.4
Trinity-San Jacinto Coastal	1	21.8	26.2	48.0	17.7	70.0	87.7	25.0	127.2	152.2
San Jacinto	2	356.1	33.6	389.7	231.0	944.2	1,175.2	161.9	2,154.1	2,316.0
San Jacinto-Brazos Coastal	1	80.9	60.0	140.9	42.8	305.0	347.8	42.8	636.4	679.2
Total		483.2	125.4	608.6	340.3	1,361.4	1,701.7	278.8	3,063.0	3,341.8

Source: Texas Water Development Board, The Texas Water Plan, Austin, Texas, November 1968.

capacity of 4,200 megawatts. The nine plants use about 1,900 MGD for once-through cooling and about 17 MGD of water for consumptive cooling purposes. In 1967 there were 18 industrial generating plants in the area with an installed capacity greater than 1,000 kilowatts. The total installed capacity of the 18 plants is about 1,168 megawatts. These plants use about 870 MGD for once-through cooling and about 8 MGD for consumptive cooling purposes. Condenser use and consumptive use are projected to increase to 12,000 MGD and 86 MGD, respectively, by 1990. Comparable projections for 2020 are 24,000 MGD and 288 MGD.

Navigation

The Houston-Galveston-Texas City port complex is one of the largest deep-water harbor areas in the United States. The tonnage handled by these three ports in 1966 was greater than 82 million short tons. Several smaller ports in the Galveston Bay area added about 2 million short tons of shipping to the 1966 total. Principal exports and imports include raw and refined petroleum and petroleum products, chemicals and related products, grain and food products, iron ore and sulphur.

Commercial shipping is generally of two types: Ocean-going traffic which enters Galveston Bay through the entrance channel, and shallow-draft barge traffic which moves through inland channels to and from terminals on the Gulf Intracoastal and other inland waterways. Vessel traffic during 1966 amounted to about 19,500 ocean-going ships and 77,900 shallow-draft barges.

Two planned developments, a shallow-draft channel to open the Trinity River to navigation upstream to the Dallas-Fort Worth area and a new deep-water port facility at Morgan Point, are expected to bring about additional ship and barge traffic in the Galveston Bay area.

Recreation

The major water-oriented recreation activities in the Galveston Bay area are swimming, boating, camping, picnicking, water sports, fishing, and hunting[2/]. In a 27-county study area which included the Galveston Bay area, there were 69,000 feet of established saltwater beaches, 160 boat ramps, and about 2,300 boat-car parking spaces in 1968. A shortage of 9,000 campsites is expected by 1975. Dock and pier space for saltwater fishing totaled 369,000 square feet in 31 structures.

Increases in population, available leisure time and personal incomes contribute to the growing demands for recreational facilities. Because it is adjacent to the most populated metropolitan center in Texas, Galveston Bay is probably the most important coastal area in terms of recreational resources. The full value of this resource cannot be realized unless suitable water quality is maintained.

[2/] Texas Water Quality Board, Socio-Economic Study, Galveston Bay Area. A report to the Federal Water Pollution Control Administration in fulfillment of a contract, Austin, Texas, May 1969.

Irrigation

The total irrigated acreage in the vicinity of Galveston Bay in 1964 was about 258,000 acres. Irrigation water is obtained from ground and surface sources and is used principally for rice production. The irrigated acreage is projected to increase to 278,000 acres in 1990 and 297,000 acres in 2020.

Shellfish Harvesting

Commercial fishing and shellfishing in the Galveston Bay system amounts to nearly five million pounds per year, providing year-round employment for bay area residents as well as seasonal employment for commercial fishermen from Louisiana coastal areas.

The amount and value of oysters harvested from the Galveston Bay estuary has fluctuated significantly from year to year. Oyster harvest data for the 1955-1969 period are presented in Table IV-2. For this period, the annual harvest of oyster meat ranged from 311,000 pounds in 1958 to 4,836,000 pounds in 1965. The corresponding range in dockside value of the meat was $118,000 in 1958 to $1,604,000 in 1966. The average price for oyster meat fluctuated independently of the Galveston Bay supply and ranged from $0.28 per pound in 1957 and 1959 to $0.44 per pound in 1967 and 1968.

Examination of the data shows a sharp increase in oyster harvest beginning in 1959. This change was tempoarily reversed in 1961 by Hurricane Carla which extensively damaged shellfish beds. The harvest rapidly increased between 1961 and 1965, the peak

TABLE IV-2

OYSTER HARVEST AND VALUE
GALVESTON BAY, TEXAS

Year	Total Oyster Harvest: Oyster Meat (1,000 lbs.)	Total Oyster Harvest: Market Value ($1,000)	Average Price ($/lb.)	Bed Area (Acres)	Oyster Yield (lbs./Ac.)
1955	543	160	0.30	8,800	62
1956	986	285	0.29	8,800	112
1957	953	262	0.28	8,800	108
1958	311	118	0.38	8,800	35
1959	1,411	396	0.28	8,800	160
1960	2,296	655	0.29	8,600	268
1961	1,096	329	0.30	8,600	128
1962	1,211	473	0.39	8,600	141
1963	2,618	914	0.35	8,600	305
1964	3,357	1,093	0.33	8,600	391
1965	4,836	1,538	0.32	8,600	562
1966	4,083	1,604	0.39	8,900	458
1967	2,993	1,320	0.44	8,900	336
1968	2,839	1,250	0.44	8,900	319
1969	3,447	N.A.	N.A.	9,100	378
Total	32,980	10,397	-	-	-
Average	2,199	743	0.34	8,760	251
1963-69 Average	3,453	1,270	0.38	8,800	392

Source: Texas Parks & Wildlife Department.

harvest year. During this period, the approved area for shellfish harvesting remained constant. Other factors, such as a decrease in the size limit for harvesting oysters and an increase in the number of out-of-state oystermen taking shellfish from the estuary, are believed to account for much of the increase in harvest. For the past three years, the harvest has been relatively constant, indicating a stable production may be occurring.

V. WATER QUALITY

A. APPLICABLE STANDARDS

The Texas Water Quality Requirements provide specific numerical criteria for fourteen zones in the Galveston Bay area. The locations of these zones are shown in Figure V-1. Table V-1 summarizes the applicable criteria.

The Requirements also provide for classification of shellfish producing areas, as "approved," "conditionally approved," "restricted," or "prohibited," based upon criteria contained in the U.S. Public Health Service manual, "Sanitation of Shellfish Growing Areas," 1965, revised. The criteria for approved shellfish areas are, in summary form:

(1) The area is not so contaminated with fecal material that consumption of shellfish might be hazardous.

(2) The area is not so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be hazardous.

(3) The coliform median MPN of the water does not exceed 70/100 ml, and not more than 10 percent of the samples ordinarily exceed an MPN of 230/100 ml (5 tube decimal dilution test) measured under the most unfavorable hydrographic and pollution conditions.

The Texas Water Quality Requirements and the Shellfish Sanitation Manual are reproduced in Appendix A.

TABLE V-1
SUMMARY OF TEXAS WATER QUALITY STANDARDS APPLICABLE TO GALVESTON BAY AND HOUSTON SHIP CHANNEL

	NUMERICAL CRITERIA								WATER USES[1/]	
Zone	Chloride Average mg/1	Sulphate mg/1	Filterable Residue Average mg/1	BOD Average mg/1	Dissolved Oxygen not less than mg/1	MPN Log. Average per 100 ml	pH Range	Temperature °F	Suitable	Known
0901 - Gulf of Mexico at Galveston	20,000	3,000	45,000	1.0	7.0	5.0	7.0-9.0	ALL ZONES - SUMMER 1.5° RISE - SPRING, FALL, WINTER 4° RISE	A,I	A
0902 - Trinity River Tidal	6,000	500	10,000	4.0	6.0	1,000	7.0-9.0		A,I	A
0903 - San Jacinto River Tidal	10,000	1,000	20,000	2.0	4.0	50	6.2-8.5		A,I	A,I
0904 - Houston Ship Channel (Turning Basin area)	4,000	600	9,500	7.0	1.5	100,000	6.0-8.5		E,I,N	I,N
0905 - Houston Ship Channel (San Jacinto Monument to Turning Basin)	7,000	1,000	16,000	5.0	2.0	10,000	6.0-8.5		B,I	B,I
0906 - Houston Ship Channel (Morgan Point to San Jacinto Monument)	10,000	1,000	20,000	2.0	4.0	50	6.2-8.5		A,I	A,I
0907 - Clear Lake	5,000	700	12,000	3.0	6.0	70	7.0-9.0		A,I	A
0908 - Texas City Ship Channel	17,000	2,000	35,000	8.0	3.0	1,000	7.0-9.0		A,I	A
1101 - East Bay	12,000	1,200	25,000	3.0	6.0	70	7.0-9.0		A,I	A
1102 - Galveston Bay (East of Houston Ship Channel, Bounded by Channel Marker 68, Fisher Shoals Day Beacon #1, Lone Oak Bayou, Smith Point, Hanna Reef and Bolivar Peninsula)	12,000	1,200	25,000	4.0	6.0	70	7.0-9.0		A,I	A
1103 - Trinity Bay and Galveston Bay (East of Houston Ship Channel and North of Channel Marker 68 and Fisher Shoals Day Beacon #1)	10,000	700	20,000	5.0	5.0	70	7.0-9.0		A,I	A,I
1104 - Galveston Bay (West of Houston Ship Channel)	12,000	1,500	25,000	6.0	5.0	70	7.0-9.0		A,I	A,I
1105 - West Bay (East of Carancahua Reef)	16,000	2,000	32,000	3.0	5.0	70	7.0-9.0		A,I	A
1106 - West Bay (West of Carancahua Reef)	16,000	2,000	32,000	2.5	6.0	70	7.0-9.0		A,I	A

NARRATIVE CRITERIA APPLICABLE TO ALL ZONES

1. Toxicity and Toxic Materials - These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters.
2. Free or Floating Oil - Substantially free from oil.
3. Foaming or Frothing Material - None of a persistent nature.
4. Other - The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual, "Sanitation of Shellfish Growing Area," 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.
5. Radioactive Materials - Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

[1/] Key to Water Uses.
Group A - Contact Recreation, Non-Contact Recreation, Fish and Wildlife, Fishing, Aesthetics, Navigation.
Group B - Non-Contact Recreation, Aesthetics, Navigation.
Group E - Aesthetics.
Group I - Industrial Cooling Water.
Group N - Navigation.

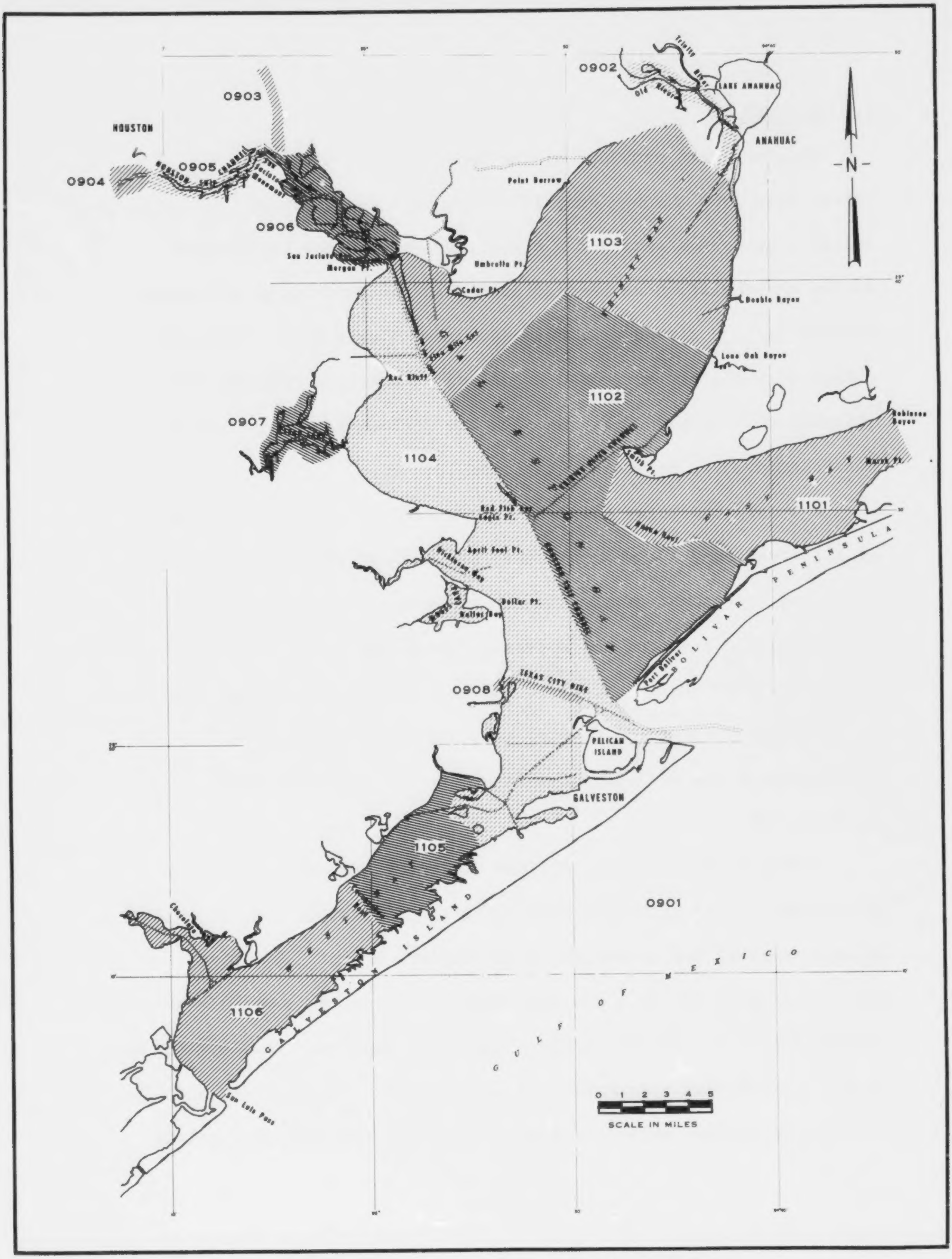

0902
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
0903
HOUSTON
0904
0905
HOUSTON SHIP CHANNEL
San Jacinto Monument
0906
San Jacinto Pt.
Morgan Pt.
Point Barrow
Umbrella Pt.
Cedar Pt.
1103
TRINITY BAY
N
Double Bayou
Lone Oak Bayou
1102
Red Bluff
0907
1104
Smith Pt.
Robinson Bayou
Marsh Pt.
EAST BAY
1101
Red Fish Bar
Eagle Pt.
April Fool Pt.
Dollar Pt.
PENINSULA
BOLIVAR
Port Bolivar
0908
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
1105
WEST BAY
0901
Chocolate Bay
1106
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

Figure V-1 Water Quality Standards Zones in the Galveston Bay Area

B. COLIFORM

Coliform data obtained by the Galveston Bay Study for the period July 1968 through June 1970 show that shellfish harvesting criteria have been exceeded a significant percentage of the time during the shellfish harvesting season in approved areas and almost continuously in closed or prohibited areas (Table V-2). Classification of shellfish areas and locations of sampling stations are illustrated in Figure V-2. Samples are collected monthly from a network of widely separated stations.

Although the total coliform median limit of 70/100 ml is met at all locations in the open areas, the 230/100 ml limit is exceeded more than 10 percent of the time in at least three locations in, or immediately adjacent to, approved harvesting areas. Two of these locations are in Galveston Bay (Stations 4 and 23) and one in West Bay (Station 13). Total coliform concentrations were acceptable in the area of the most productive shellfish reef (Station 28).

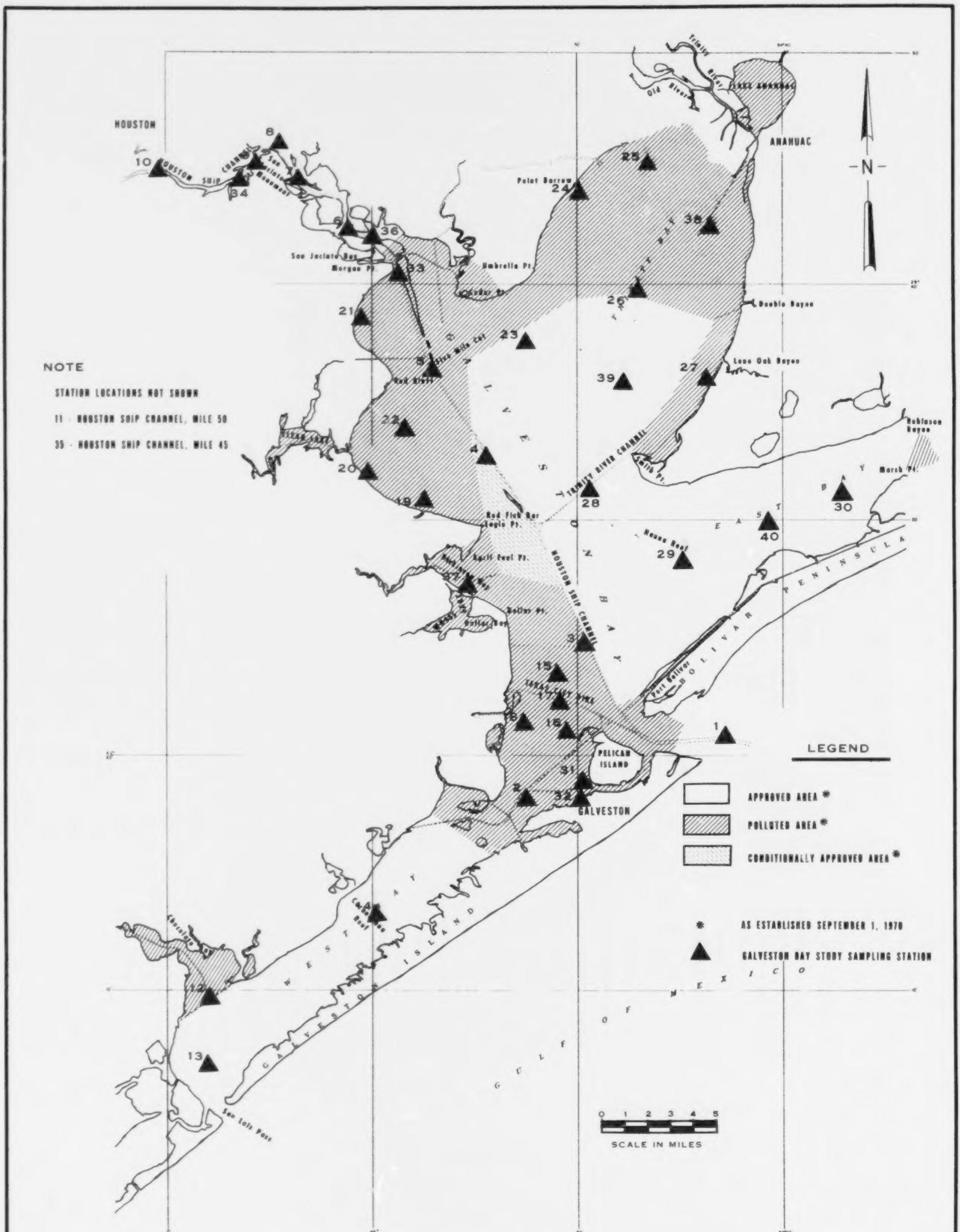
A supplementary fecal coliform criterion was recommended and discusssed at the Fifth National Shellfish Sanitation Workshop (1964). It was proposed that a median fecal coliform MPN of 7.8/100 ml not be exceeded and that not more than 10 percent of samples should exceed 33/100 ml. Fecal coliform organisms have been demonstrated to almost exclusively originate from the digestive tract of man and other warm blooded animals and are, therefore, presumedly a better

TABLE V-2

MEDIAN VALUES OF TOTAL COLIFORM CONCENTRATIONS AND PERCENTAGE OF SAMPLES GREATER THAN 230 COLIFORM/100 ML AT SELECTED STATIONS IN GALVESTON BAY FOR THE PERIODS DECEMBER 1968-APRIL 1969 AND DECEMBER 1969-APRIL 1970

Station Number	Area Classification	Surface		1/3 Depth		1/2 Depth		2/3 Depth		Bottom	
		Median	Percent > 230	Median	Percent > 230	Median	Percent > 230	Median	Percent > 230	Median	Percent > 230
1	Closed	79	18	27	9			14	18	8	9
2	Closed	79	30			130	36				
3	Closed	49	9	33	18			49	9	79	18
4	Edge of open area	33	45	49	55			33	45	33	55
5	Closed	130	36	310	64			330	57	49	27
12	Closed	13	36			14	18				
13	Open	2	9			< 2	18				
14	Open	2	0			5	0				
15	Closed	11	9			17	9				
16	Closed	490	73			940	64				
17	Closed	11	0			17	9				
18	Closed Conditional	8	9			7	9				
19	Closed	330	45			330	55				
20	Closed	230	45			330	55				
21	Closed	700	74			700	74				
22	Closed	49	18			49	18				
23	Open	33	27			26	18				
24	Closed	240	55			221	45				
25	Closed	1,600	73			790	73				
26	Closed	23	18			14	18				
27	Closed	130	36			33	36				
28	Open	5	9			7	9				
29	Open	2	0			5	0				
30	Open	2	0			2	0				
31	Closed	790	91			490	73				
32	Closed	13,000	100			33,000	100				
33	Closed	2,400	100	3,300	91			1,720	82	630	73
38	Closed	460	67	175	33						

33 ---Samples December 1969-April 1970 only.


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
Red Bluff
Red Fish Bar
Eagle Pt.
April Fool Pt.
Dollar Pt.
Dollar Bay
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Robinson Bayou
Smith Pt.
Marsh Pt.
TRINITY RIVER CHANNEL
HOUSTON SHIP CHANNEL
GALVESTON BAY
EAST BAY
Hanna Reef
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
WEST BAY
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
N
1
2
3
4
5
6
7
8
10
12
13
15
16
17
18
19
20
21
22
23
24
25
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27
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29
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31
32
33
34
36
37
38
39
40
NOTE
STATION LOCATIONS NOT SHOWN
11 - HOUSTON SHIP CHANNEL, MILE 50
35 - HOUSTON SHIP CHANNEL, MILE 45
LEGEND
APPROVED AREA *
POLLUTED AREA *
CONDITIONALLY APPROVED AREA *
* AS ESTABLISHED SEPTEMBER 1, 1970
GALVESTON BAY STUDY SAMPLING STATION
0 1 2 3 4 5
SCALE IN MILES

Figure V - 2 Galveston Bay Study Sampling Stations and Classifications of Shellfish Harvesting Areas

indicator of recent pollution from these sources than total coliform. The concentrations for Galveston Bay are summarized in Table V-3. The same pattern as total coliform is demonstrated, with the recommended criteria being violated at the same three locations in the open areas. The median concentration near the most productive reef was less than the lower limit tested and no measured values exceeded 33/100 ml during the 1969 and 1970 harvesting seasons.

Lines of equal total coliform concentrations (iso-lines) as well as percentage of time that concentrations exceeded 230/100 ml are shown in Figures V-3 and V-4. The excessive concentrations of coliform pollution emanate primarily from the Houston Ship Channel. Increased concentrations of bacteriological pollution in Galveston Bay are attributable to waste discharges from the Clear Lake area and the City of Galveston. Concentrations are slightly higher in the Chocolate Bayou and East Bay areas. The iso-lines also demonstrate that, in a large portion of the approved shellfish harvesting area, total coliform concentrations will exceed 230/100 ml more than 10 percent of the time.

To determine the pattern of coliform pollution under differing hydrological and meteorological conditions, iso-lines were analyzed for January 14, February 18, and March 18, 1969 as well as January 14, February 10, and March 10, 1970. These coliform distributions are illustrated in Figures V-5 through V-10. Meteorological and hydrological conditions existing prior to and on the date of

TABLE V-3

MEDIAN FECAL COLIFORM CONCENTRATIONS AND PERCENTAGE OF SAMPLES WITH FECAL COLIFORM CONCENTRATIONS GREATER THAN 33/100 ML AT SELECTED STATIONS IN GALVESTON BAY FOR THE PERIODS DECEMBER 1968-APRIL 1969 AND DECEMBER 1969-APRIL 1970

Station Number	Area Classification	Surface		1/3 Depth		1/2 Depth		2/3 Depth		Bottom	
		Median	Percent > 33	Median	Percent > 33	Median	Percent > 33	Median	Percent > 33	Median	Percent > 33
1		20	36	7	9			5	9	4	9
2		22	36			33	45				
3		17	18	13	36			17	27	21	36
4	Edge of open area	2	0	8	18			8	9	5	18
5		23	36	23	45			23	45	23	27
12		5	36			2	18				
13	Open	< 2	18			< 2	18				
14	Open	< 2	0			< 2	0				
15		5	45			2	27				
16		221	73			330	73				
17		5	0			7	9				
18	Conditional	< 2	9			2	9				
19		46	55			31	45				
20		33	45			49	45				
21		49	64			130	74				
22		5	9			5	0				
23	Open	5	27			2	18				
24		17	27			17	18				
25		79	73			33	55				
26		2	0			4	0				
27		13	36			2	27				
28	Open	< 2	0			< 2	0				
29	Open	< 2	0			< 2	0				
30	Open	< 2	0			< 2	0				
31		490	100			330	82				
32		7,000	100			7,900	100				
33		1,090	100	490	100			330	100	130	91
38		40	50			14	33				

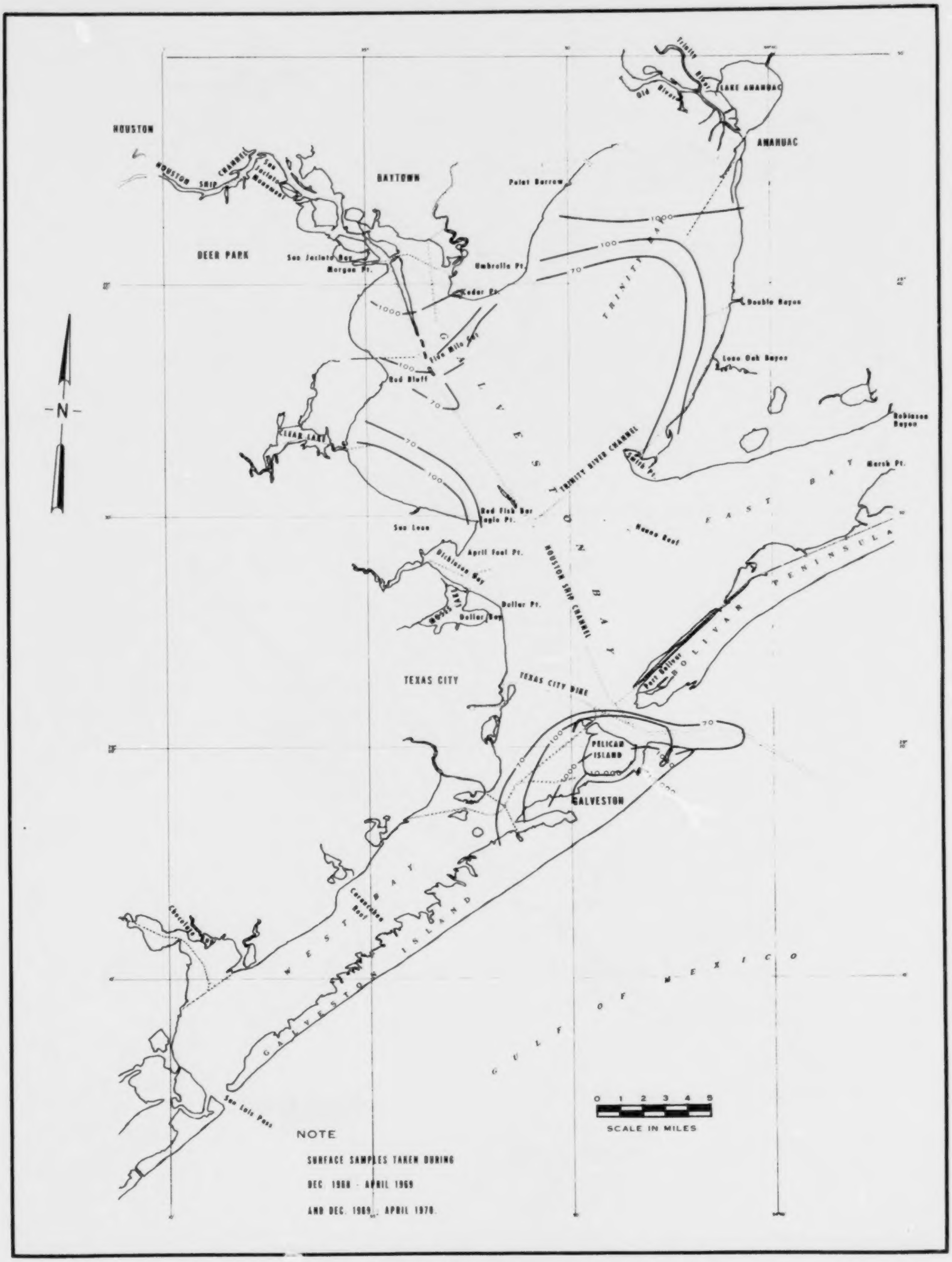
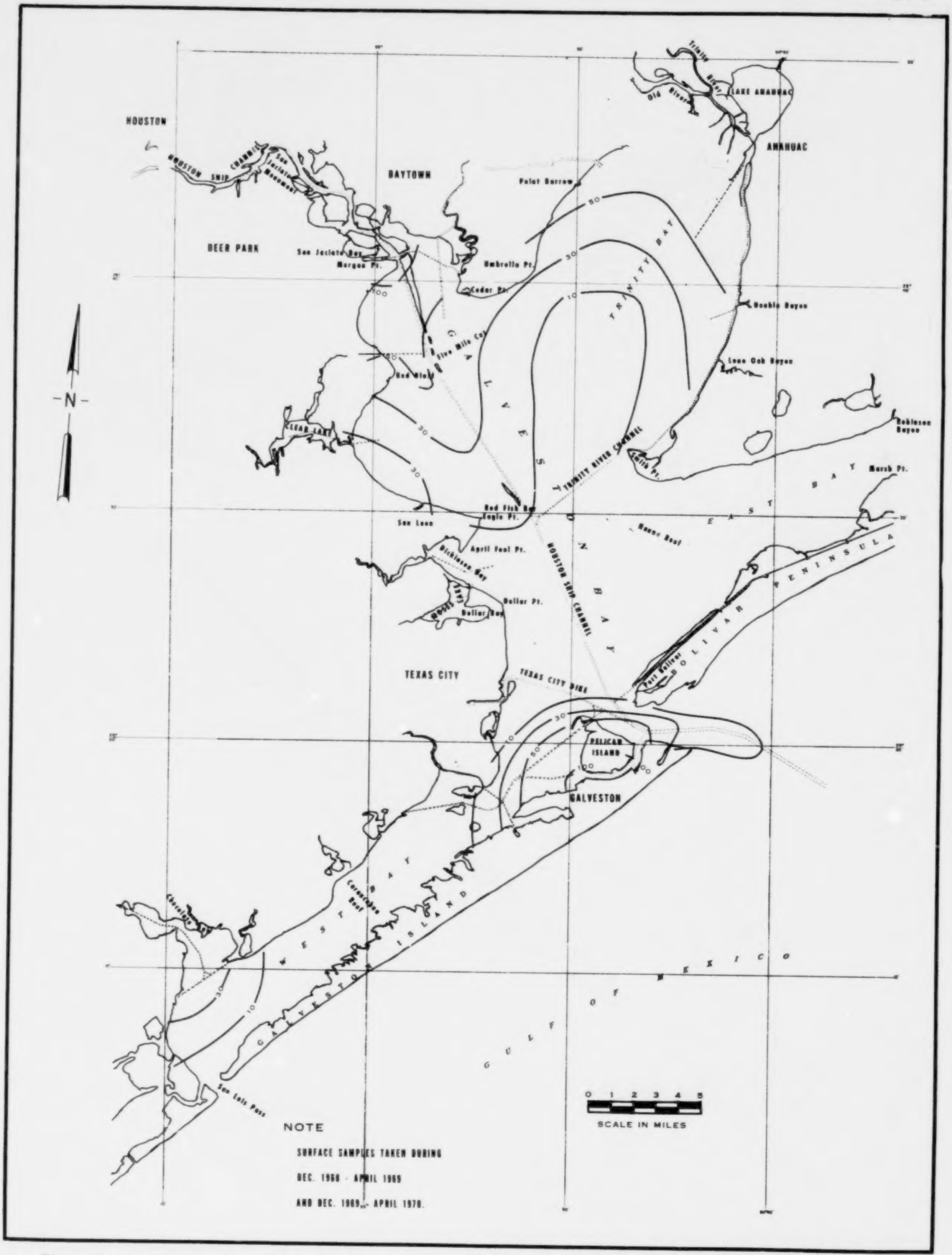

HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Point Barrow
Umbrella Pt.
Cedar Pt.
Five Mile Cut
Red Bluff
CLEAR LAKE
Red Fish Bar
Eagle Pt.
San Leon
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
TEXAS CITY
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Robinson Bayou
TRINITY RIVER CHANNEL
Smith Pt.
EAST BAY
Hanna Reef
Marsh Pt.
GALVESTON BAY
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
Port Bolivar
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
1000
100
70
10,000
N
0 1 2 3 4 5
SCALE IN MILES

Figure V - 3 Isolines of Median Coliform Concentrations, Galveston Bay.

NOTE

SURFACE SAMPLES TAKEN DURING
DEC. 1968 - APRIL 1969
AND DEC. 1969 - APRIL 1970.


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Point Barrow
Umbrella Pt.
Cedar Pt.
Five Mile Cut
Red Bluff
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TRINITY BAY
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
Double Bayou
Lone Oak Bayou
Robinson Bayou
TRINITY RIVER CHANNEL
Smith Pt.
EAST BAY
Marsh Pt.
Red Fish Bar
Eagle Pt.
San Leon
April Fool Pt.
Dickinson Bay
Moses Lake
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
Hanna Reef
TEXAS CITY
TEXAS CITY DIKE
BOLIVAR PENINSULA
Port Bolivar
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
-N-
10
30
50
100
0 1 2 3 4 5
SCALE IN MILES

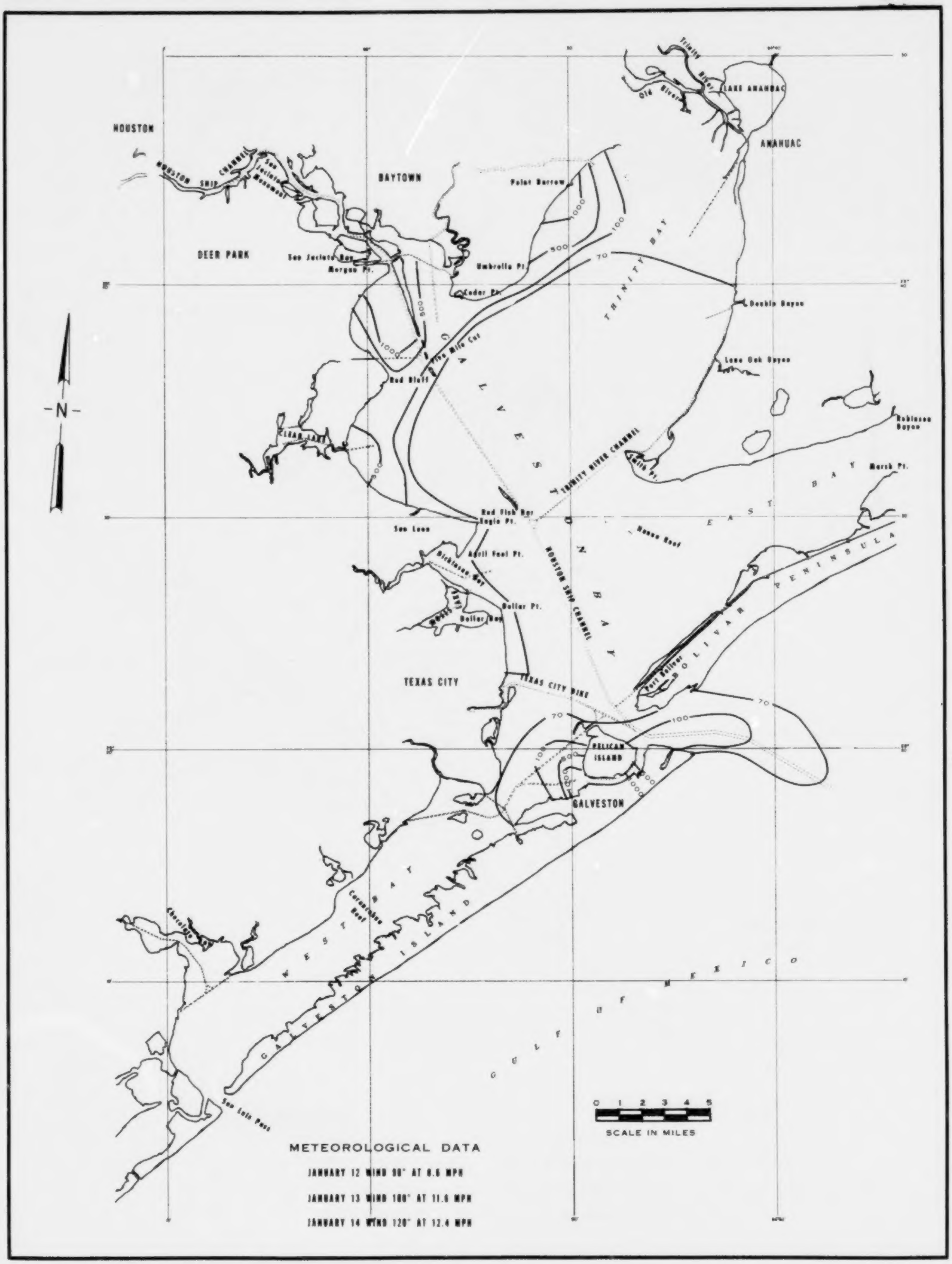
NOTE

SURFACE SAMPLES TAKEN DURING

DEC. 1968 - APRIL 1969

AND DEC. 1969 - APRIL 1970.

Figure V - 4 Percent of Samples with Total Coliform Concentrations Greater Than 230/100 ml, Galveston Bay.


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
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San Leon
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
TEXAS CITY
TEXAS CITY DIKE
Port Bolivar
BOLIVAR PENINSULA
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
70
100
500
1000
-N-
0 1 2 3 4 5
SCALE IN MILES
METEOROLOGICAL DATA
JANUARY 12 WIND 90° AT 8.6 MPH
JANUARY 13 WIND 100° AT 11.6 MPH
JANUARY 14 WIND 120° AT 12.4 MPH

Figure V - 5 Isolines of Total Coliform Concentrations–Galveston Bay - January 14, 1969

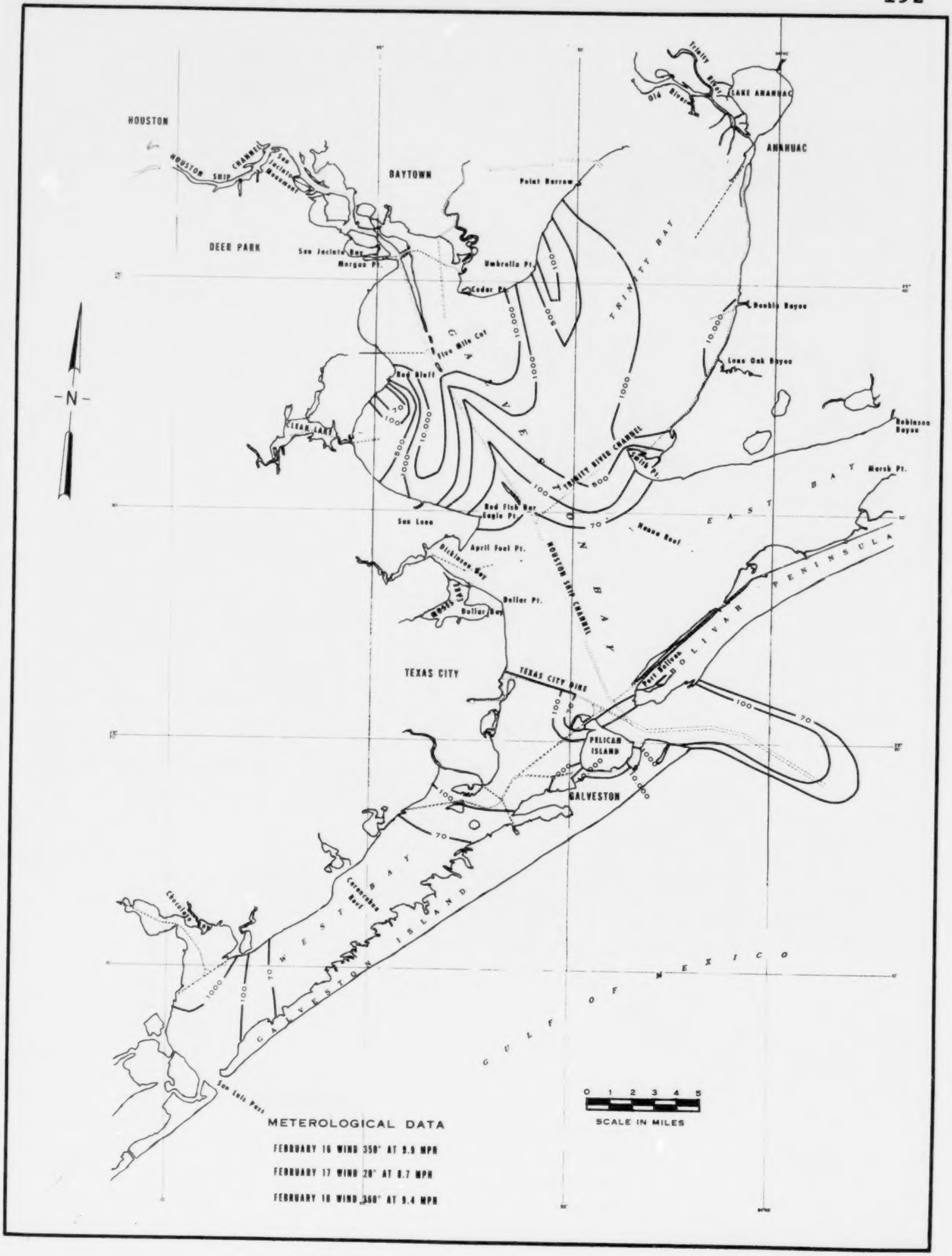
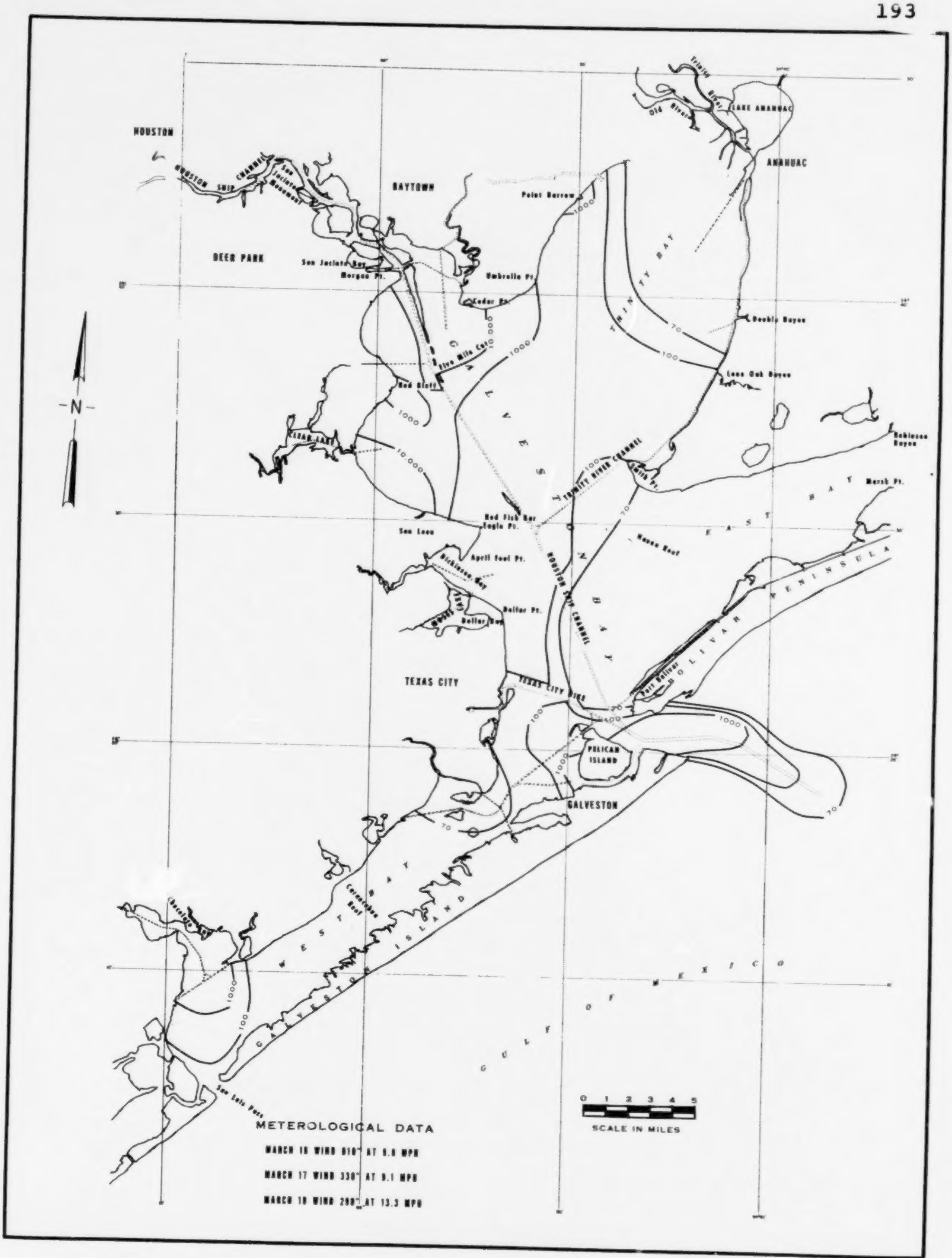

N
HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
Point Barrow
Umbrella Pt.
Cedar Pt.
TRINITY BAY
Double Bayou
Lone Oak Bayou
Five Mile Cut
Red Bluff
CLEAR LAKE
GALVESTON BAY
TRINITY RIVER CHANNEL
Smith Pt.
Robinson Bayou
EAST BAY
Marsh Pt.
Red Fish Bar
Eagle Pt.
San Leon
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
GALVESTON ISLAND
Chocolate Bay
San Luis Pass
GULF OF MEXICO
70
100
800
1000
10,000
0 1 2 3 4 5
SCALE IN MILES
METEROLOGICAL DATA
FEBRUARY 16 WIND 350° AT 9.9 MPH
FEBRUARY 17 WIND 20° AT 8.7 MPH
FEBRUARY 18 WIND 360° AT 9.4 MPH

Figure V - 6 Isolines of Total Coliform Concentrations–Galveston Bay - February 18, 1969


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Five Mile Cut
Red Bluff
CLEAR LAKE
GALVESTON BAY
TRINITY RIVER CHANNEL
Smith Pt.
Robinson Bayou
Marsh Pt.
EAST BAY
Red Fish Bar
Eagle Pt.
San Leon
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
TEXAS CITY
TEXAS CITY DIKE
Port Bolivar
BOLIVAR PENINSULA
PELICAN ISLAND
GALVESTON
WEST BAY
Confederate Reef
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
-N-
1000
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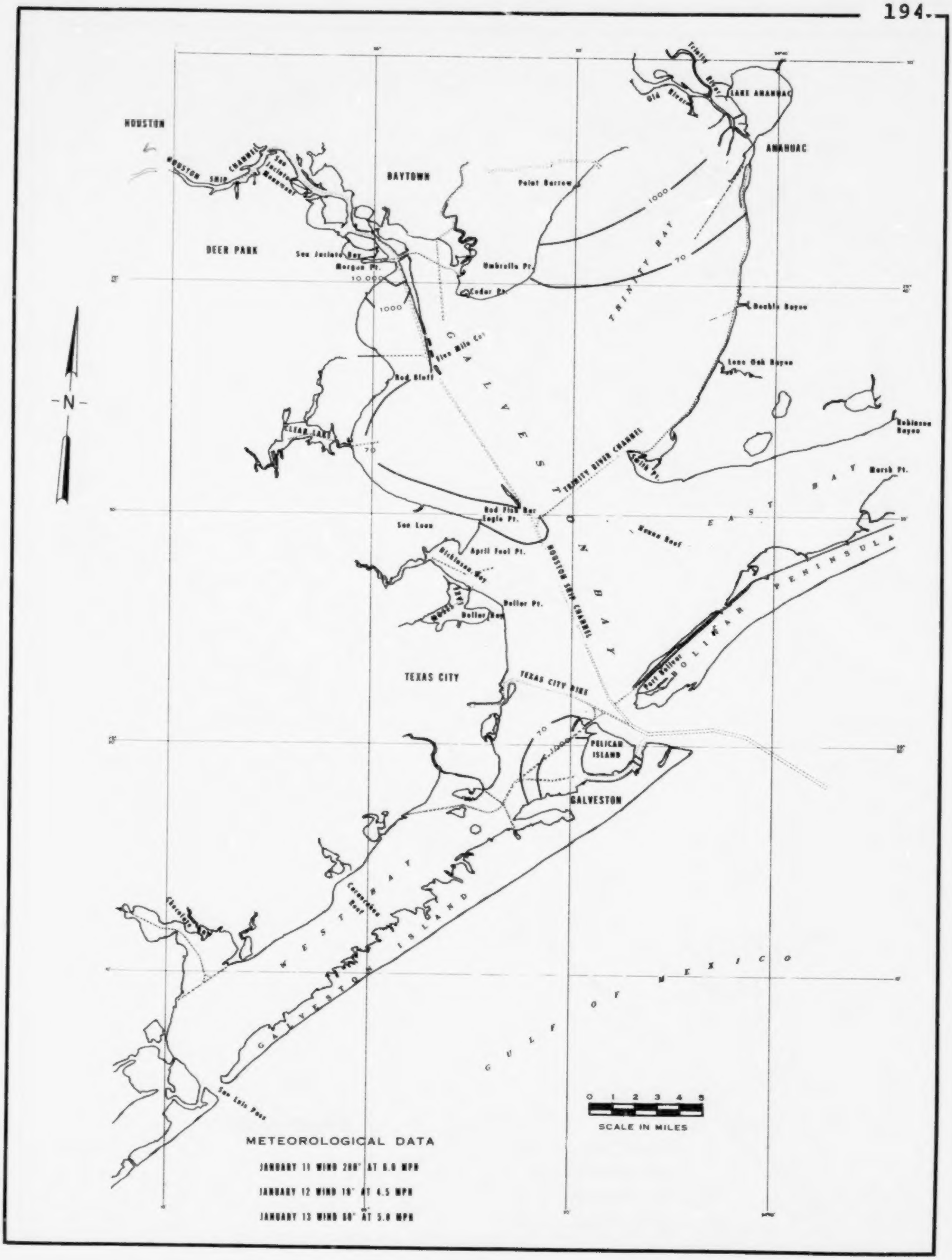
70
0 1 2 3 4 5
SCALE IN MILES
METEROLOGICAL DATA
MARCH 16 WIND 010° AT 9.8 MPH
MARCH 17 WIND 330° AT 9.1 MPH
MARCH 18 WIND 290° AT 13.3 MPH

Figure V - 7 Isolines of Total Coliform Concentrations–Galveston Bay - March 18, 1969


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
10,000
1000
Point Barrow
Umbrella Pt.
Cedar Pt.
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
1000
70
TRINITY BAY
Double Bayou
Five Mile Cut
Red Bluff
GALVESTON BAY
Lone Oak Bayou
Robinson Bayou
CLEAR LAKE
70
TRINITY RIVER CHANNEL
Smith Pt.
EAST BAY
Marsh Pt.
Red Fish Bar
Eagle Pt.
San Leon
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY
TEXAS CITY DIKE
70
1000
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
-N-
0 1 2 3 4 5
SCALE IN MILES

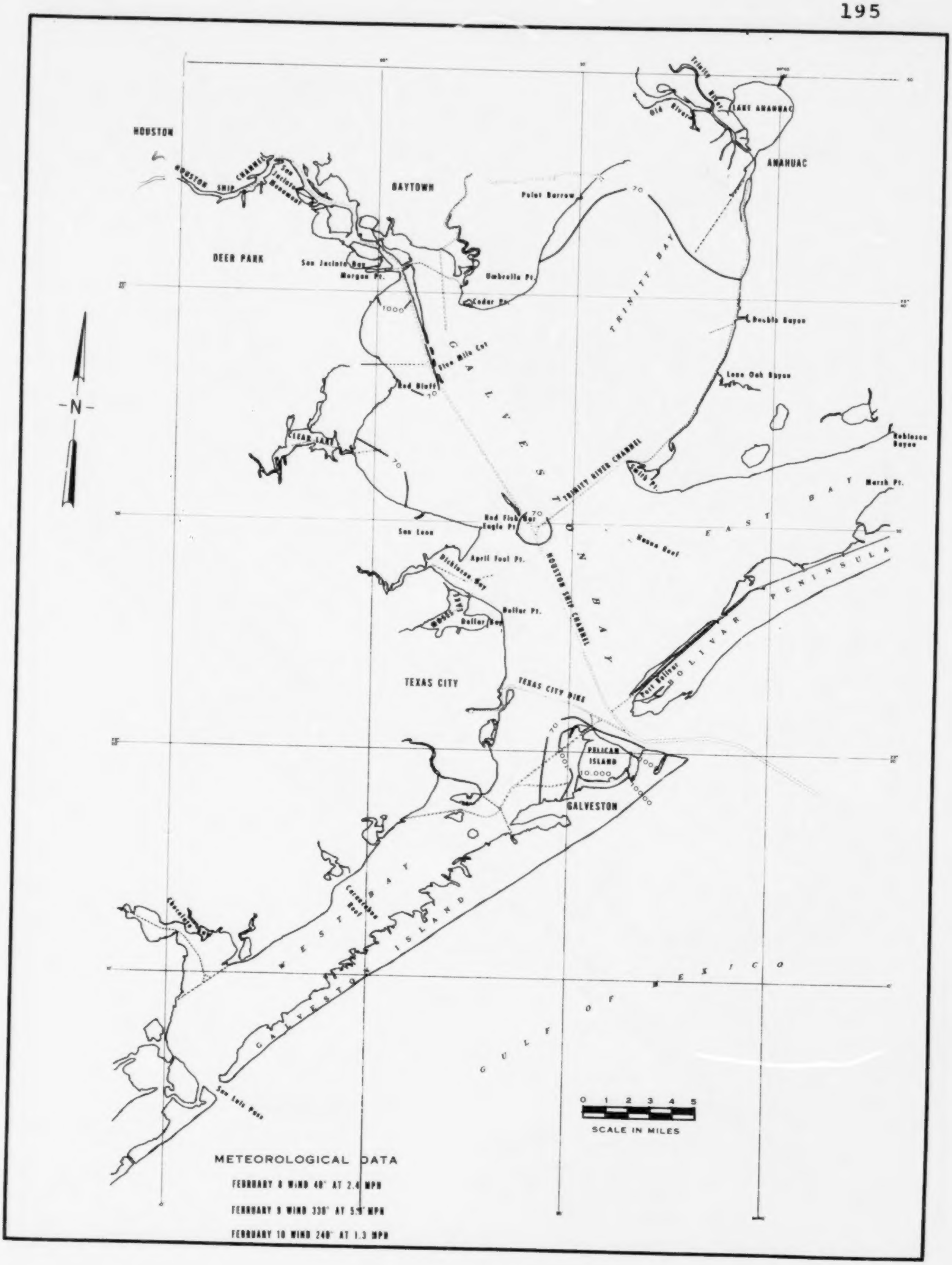
METEOROLOGICAL DATA

JANUARY 11 WIND 200° AT 6.0 MPH

JANUARY 12 WIND 10° AT 4.5 MPH

JANUARY 13 WIND 60° AT 5.0 MPH

Figure V - 8 Isolines of Total Coliform Concentrations - Galveston Bay - January 13, 1970


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Robinson Bayou
Five Mile Cut
Red Bluff
CLEAR LAKE
GALVESTON BAY
TRINITY RIVER CHANNEL
Smith Pt.
EAST BAY
Marsh Pt.
Red Fish Bar
Eagle Pt.
San Leon
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
Moses Lake
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
TEXAS CITY
TEXAS CITY DIKE
Port Bolivar
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
70
1000
10,000
-N-
0 1 2 3 4 5
SCALE IN MILES

METEOROLOGICAL DATA

FEBRUARY 8 WIND 40° AT 2.4 MPH

FEBRUARY 9 WIND 330° AT 5.9 MPH

FEBRUARY 10 WIND 240° AT 1.3 MPH

Figure V -9 Isolines of Total Coliform Concentrations-Galveston Bay - February 10, 1970

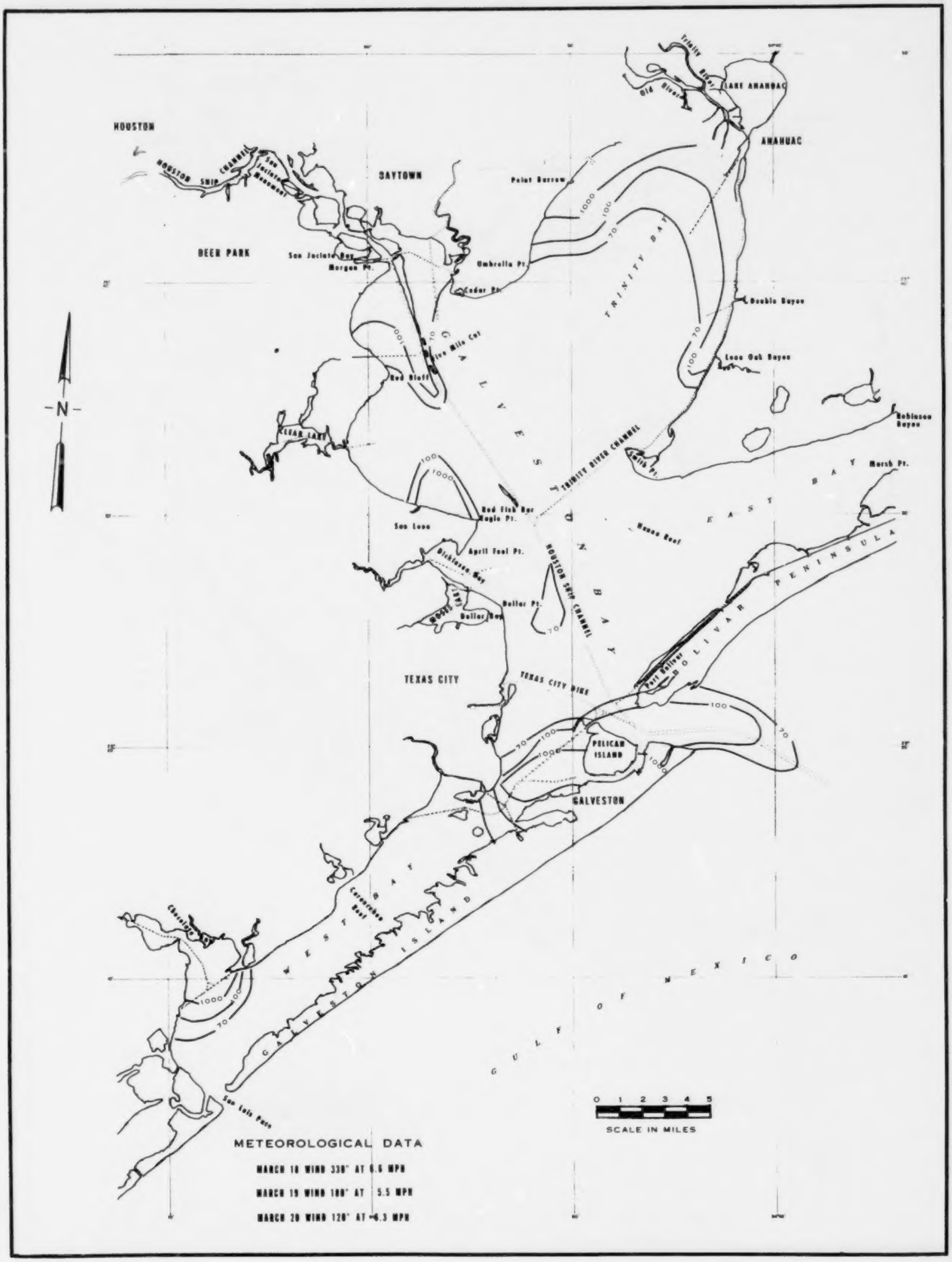

HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN
DEER PARK
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Robinson Bayou
Smith Pt.
Marsh Pt.
Red Bluff
CLEAR LAKE
Seven Mile Cut
GALVESTON BAY
TRINITY RIVER CHANNEL
Red Fish Bar
Eagle Pt.
San Leon
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
Moses Lake
Hanna Reef
EAST BAY
HOUSTON SHIP CHANNEL
TEXAS CITY
TEXAS CITY DIKE
Port Bolivar
BOLIVAR PENINSULA
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
GALVESTON ISLAND
Chocolate Bay
San Luis Pass
GULF OF MEXICO
1000
100
70
N
0 1 2 3 4 5
SCALE IN MILES
METEOROLOGICAL DATA
MARCH 18 WIND 330° AT 6.6 MPH
MARCH 19 WIND 100° AT 5.5 MPH
MARCH 20 WIND 120° AT 6.3 MPH

Figure V-10 Isolines of Total Coliform Concentrations–Galveston Bay - March 10, 1970

sampling were examined. Strong north or northwest winds, with accompanying precipitation, cause excessively high coliform concentrations in the approved harvesting area. On February 18, 1969, after three days of strong northerly winds and 1.8 inches of rain recorded on February 13, virtually the entire approved area of the Bay had total coliform concentrations in excess of 100/100 ml with 542/100 ml observed immediately adjacent to the most productive shellfish reefs. Similar conditions occurred on March 18, 1969 (variable northerly winds with 1.45 inches of rain recorded from March 15-17) and again, coliform concentrations exceeded 100/100 ml in nearly all of the approved areas with the exception of East Bay. The shellfish areas in Galveston Bay were temporarily closed during this period. In contrast, winds from the northeast, east, or southeast with no precipitation are the most favorable conditions for low coliform concentrations in the approved harvesting areas as evidenced by the iso-lines for January 14, 1969, January 13, 1970, and February 10, 1970. These meteorological and hydrological conditions minimize the effect of pollution discharged to the Houston Ship Channel and Clear Lake areas by confining it to the immediate areas of discharge. Periods of rainfall cause significant bacteriological contributions from Double Bayou on the east side of the Bay to the approved harvesting area in Galveston Bay, and from Chocolate Bayou to approved areas in West Bay. Coliform pollution is also contributed from the Point Barrow area. During relatively calm conditions, allowable coliform concentrations for shellfish harvesting will be exceeded in the northern and western portions of the approved areas in Galveston Bay due to pollution from the Houston Ship Channel and Clear Lake areas. There is also a substantial increase in coliform pollution due to discharge from the City of Galveston. However, this does not significantly influence concentrations in the approved areas.

If coliform concentrations in Galveston Bay were regularly measured during the most unfavorable hydrographic and pollution conditions as required by the applicable standards for acceptability for shellfish harvesting, it is probable that all of Galveston Bay with the exception of areas in East Bay would be closed to shellfish harvesting due to pollution. During the 1968-1969 harvesting season, hydrological and meteorological conditions were unfavorable for maintenance of suitable bacteriological quality as much as 40 percent of the time. Part of the approved areas of Galveston Bay are presently in violation of the criteria for acceptable shellfish harvesting as defined by Federal and State standards. Approval of areas for shellfish harvesting in Galveston Bay should reflect sampling under the most unfavorable hydrographic and pollution conditions as required.

C. HEAVY METALS AND PESTICIDES

The Texas Water Quality Standards do not specify numerical limits for heavy metals or pesticides. Acute or chronic toxicity to human, animal or aquatic life is prohibited. Criteria for approved shellfish areas prohibit contamination by industrial wastes such that consumption of shellfish might be hazardous.

It is estimated, from samples collected in February 1969 by the Texas Water Quality Board, that 1,600 pounds per day of lead, 7,900 pounds per day of zinc, 5,000 pounds per day of cadmium, and 300 pounds per day of chromium are discharged primarily to the Houston Ship Channel. The Houston Ship Channel also receives 400 pounds per day of phenols and at least 1,000 pounds per day of cyanide, a highly toxic chemical, principally from the Armco Steel Company. Observed concentrations of metals in the Houston Ship Channel near water supply intakes are summarized in Table V-4 from the Texas Water Quality Board data and from WQO-EPA data collected during November 1970 in Galveston Bay and the Houston Ship Channel. The Federal Water Quality Administration's sampling locations are shown in Figure V-11. Although numerical criteria have not been established for most of these substances, maximum concentrations observed were grossly in excess of natural background ranging from 8.5 times greater than background for nickel to 108,000 times greater than background for chromium. Concentrations of metals found at all sampling stations in Galveston Bay and the Houston Ship Channel by WQO-EPA indicate widespread and relatively uniform contamination throughout the system.

Sediment samples were collected from the Houston Ship Channel, West Bay near Galveston, and Trinity Bay during the summer of 1969 1/.

1/ Copeland, B. J., and W. G. Fruh, Ecological Studies of Galveston Bay, Final Report to the Texas Water Quality Board - Contract IAC (68-69), 408, 1969.

TABLE V-4

CONCENTRATIONS OF HEAVY METALS
GALVESTON BAY - HOUSTON SHIP CHANNEL

Metal	Background Sea Water Concentration* µg/l**	Maximum Observed Concentration µg/l		Order of Magnitude Above Background	
		1/	2/	1/	2/
Lead	0.03	1,900	20	63,300	-
Zinc	10.0	14,000	1,550	1,400	155
Cadmium	80.0	1,200	-	15	-
Copper	3.0	10,800	360	3,600	120
Strontium	-	4,700	240	-	-
Mercury	0.03	130	-	4,340	-
Nickel	5.4	-	46	-	8.5
Chromium	0.005	-	540	-	108,000

* Water Quality Criteria - Report of the National Technical Advisory Committee to the Secretary of the Interior, Federal Water Pollution Control Administration, April 1968.

** Micrograms per liter.

1/ Texas Water Quality Board Data - February 1969.

2/ Federal Water Quality Administration Data - November 1970.

Significant quantities of chlorinated hydrocarbon compounds ranging to over 70 micrograms per kilogram (μg/kg) were observed in the Houston Ship Channel and Galveston areas. No chlorinated hydrocarbons were detected in sediments from Trinity Bay, an area which does not presently receive measurable quantities of municipal or industrial waste discharge. All areas exhibited significant quantities of cadmium, tin, and lead in sediment samples. Concentrations were 0.31 milligrams per gram (mg/g) for cadmium; 0.62 mg/g of tin; and 0.93 mg/g of lead. Mercury concentrations in sediments from the Houston Ship Channel were as high as 2,100 milligrams per kilogram (mg/kg). (See correction on page 203.)

Bioassays conducted on Houston Ship Channel water indicate that concentrations of toxic compounds are three times greater than levels which could be tolerated for normal algal growth[2/]. The natural biota of Galveston Bay have been severely damaged by the discharge of toxic wastes, primarily in the Houston Ship Channel. The diversities, numbers, and weights of fish, shrimp, and crabs as well as the diversities of phytoplankton and benthic animals were very low at Morgan Point near the mouth of the Houston Ship Channel and increased in the Bay in proportion to distance from the channel. Fish collected in upper Galveston Bay were generally very small, and those collected at Morgan Point "were in poor physical

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[2/] Copeland, B. J., and W. G. Fruh, Ecological Studies of Galveston Bay, Final Report to the Texas Water Quality Board - Contract IAC (68-69), 408, 1969.

condition. A great many were missing caudal fins and some were also missing filamentous portions of pectoral and pelvic fins." Some were blinded with hard white crusts covering their eyes.

Oyster samples were obtained from both approved and prohibited shellfishing areas in Galveston Bay during November 1970, and analyzed for metals content. These data are presented in Table V-5. Although substantial data are available on occurrence of metals in oysters generally, little or no evaluation of these concentrations has been presented concerning acute and chronic toxic levels. The hazard associated with concentrations of heavy metals and other toxic substances has not yet been firmly established by the appropriate regulatory agencies. Specific numerical criteria which signify levels of acute and chronic toxicity should be established as soon as possible.

D. OIL AND PETROCHEMICAL RESIDUES

The Texas Water Quality Requirements stipulate that all waters be "substantially free" of oil. A consistent condition of oil pollution prevails in the Galveston Bay System due to discharges of oil to the Houston Ship Channel as well as the prevalence of the petroleum related industries and vessel traffic. Oil slicks are commonplace in the Channel and are frequently observed in Galveston Bay. During 1968, 65 incidents of pollution from vessels and shore facilities were investigated by the United States Coast Guard.

MR. GALLAGHER: I would like to correct that oversight. That was in individual leases. .62 milligrams of tin and .93 per milligram of lead. Collections of most of the material was given in the final report to the Texas Water Quality Board in 1969. The quote is from 100 oyster samples.

I would like to amend it in that it has reduced its mercury discharge to 0.4 pounds per day which is less than 1/2 pound a day.

CHAIRMAN STEIN: Pardon me.

Isn't that less than 1/4 pound?

MR. GALLAGHER: Yes.

CHAIRMAN STEIN: I think this is significant. This is what we have asked the other mercury dischargers to do.

MR. GALLAGHER. It's less than 1/2 pound.

It is less than 1/4 pound a day. And Diamond Shamrock is to be commended.

CHAIRMAN STEIN: Thank you.

TABLE V-5

METALS CONCENTRATIONS IN OYSTERS FROM GALVESTON BAY[1/]
NOVEMBER 12, 1970
(MICROGRAMS PER GRAM - WET WEIGHT)

Parameter	Station No. 1	Station No. 2	Station No. 3	Station No. 4a	Station No. 5	Station No. 6	Station No. 7
Zinc	> 35.30	> 39.70	20.46	26.12	21.58	20.26	22.87
Copper	8.24	9.52	5.06	4.79	4.13	7.80	5.23
Cadmium	.41	< .15	< .15	< .15	< .15	< .15	< .15
Lead	< .30	< .30	< .30	< .30	< .30	< .30	< .30
Chromium	< .07	< .07	< .26	< .07	.27	.42	.16
Mercury	.008	.062	.028	.040	.030	.045	.007
Arsenic	< .30	< .30	< .30	< .30	.47	< .30	< .30
Boron	.87	1.65	.66	.58	.78	.38	.76
Phosphorus	270	258	102	225	185	102	196
Iron	14.71	12.30	4.63	7.34	5.55	5.93	13.10
Molybdenum	.47	1.32	1.51	1.57	1.01	.99	.29
Manganese	1.18	.67	.36	.70	.47	.50	.83
Aluminum	21.77	17.84	8.51	13.50	12.33	16.51	25.10
Beryllium	< .0015	< .0015	< .0015	< .0015	< .0015	< .0015	< .0015
Silver	.25	< .015	< .015	< .015	< .015	< .015	.11
Nickel	.24	.75	< .15	.37	< .15	< .15	.25
Cobalt	< .15	< .15	< .15	< .15	< .15	< .15	< .15
Vanadium	< .30	< .30	< .30	< .30	< .30	< .30	< .30
Barium	.20	.03	.04	.15	.07	.06	.15
Strontium	1.53	1.65	1.72	1.80	5.92	3.45	2.40

1/ See Figure V-11 for sampling locations.

Oil pollution in shellfish producing areas can cause heavy mortality in oysters[3/]. Oyster samples collected from open and closed areas in Galveston Bay in November 1970 were analyzed for oil and hydrocarbon residues at the Woods Hole Oceanographic Institution. Oysters from approved harvesting areas had concentrations of 26 parts per million (ppm) and 23 ppm. The sample from the conditionally approved area had 30 ppm of residues. Oyster tissue from a closed area near Morgan Point at the mouth of the Houston Ship Channel was grossly contaminated as evidenced by the hydrocarbon concentration of 237 ppm. The hydrocarbon residues were not generated by the oysters themselves but were derived from petroleum wastes. The distribution of hydrocarbon residues in all oyster tissues was similar, indicating the same sources of contamination. These residues represent a health hazard for consumption of oysters taken from Galveston Bay, which is directly attributable to the discharge of industrial waste from petrochemical and other related industries; leakage from oil well pumping taking place in the Bay; and from vessel pollution. Based on the concentrations observed in the oyster tissues, the Houston Ship Channel is the major source of these residues to Galveston Bay.

The State of Massachusetts closed West Falmouth Harbor to shellfish harvesting after a September 1969 oil spill. The area of closure

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[3/] McKee, J. E., and H. W. Wolf, Water Quality Criteria, Second Edition, State Water Quality Control Board, Sacramento, California, Publication No. 3-A, 1963.

was extended during 1970 due to the persistence of residues in shellfish, ranging from 4.0 ppm to 126 ppm[4/]. In the closed section of West Falmouth Harbor, residues in shellfish ranged from 4.0 ppm to 12.0 ppm. The control shellfish sample from an uncontaminated area had a concentration of 1.7 ppm. Concentrations of hydrocarbons in shellfish from approved harvesting areas in Galveston Bay are from two to six times greater than observed in closed areas of West Falmouth Harbor.

Very slight amounts of oil or petroleum products in bays and estuaries have been found to impart an oil or kerosene flavor to oyster, clams, and mussels, making them unmarketable. Numerous industries discharge oil and grease to the Houston Ship Channel and Galveston Bay, as determined from permits issued by the Texas Water Quality Board.

Oysters from Galveston Bay were analyzed for aesthetic acceptability by means of odor tests conducted on samples collected in November 1970. The subjective judgments of a panel of judges were analyzed statistically to determine the probability of true odor conditions. Odors were rated on a scale ranging from seven (no odor) to one (very extreme odor). Because some of the oysters had been collected from closed areas, no taste tests were performed.

Oysters collected from East Bay were used as control or reference samples. These were the only oysters that did not have a

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[4/] Blumer, M., et al, The West Falmouth Oil Spill, Woods Hole Oceanographic Institution, Reference No. 70-44, September 1970.

strong odor. Raw oysters from this area received odor scores of 4.8 and 4.9 on the seven-point scale, and roasted oysters were rated 5.5 by the panelists (Table V-6).

Raw oysters near the mouth of the Houston Ship Channel were rated a low 3.1 by the panel, and were characterized by petroleum odors. Oysters collected near the center of the Galveston Bay-Trinity Bay area were given a very low rating of 2.9 and emitted strong odors of sewage.

Oysters rated 3.8 and 4.0 on the odor scale were taken from Stations 3 and 5 in the open area of Red Fish Reef (Figure V-11). Oysters rated 4.0 were obtained from Station 6 in the closed area. Oysters collected from the open area of Spoonbill Reef (Station 7) had nearly acceptable odors, and were rated 4.5 and 5.3 by the testing panel. The text of the report covering the odor examinations is provided in Appendix B.

From these tests it is concluded that oysters inhabiting waters of Galveston Bay acquire unacceptable odors, and the degrees of these odors are dependent upon proximity to the Houston Ship Channel.

E. DISSOLVED OXYGEN

The Galveston Bay Study data show that dissolved oxygen (DO) criteria established for the Houston Ship Channel are being violated consistently. From Morgan Point to the San Jacinto Monument, the DO levels are below the criterion of 4.0 mg/l more than 60 percent of the time. Values in the surface layer range from zero to greater

TABLE V-6

EVALUATION OF GALVESTON BAY OYSTER MEATS FOR ODOR

	Sample							
Judge	Ref.	1	2	3	4a	5	6	7
Raw Oysters								
1	4.0	5.0	4.0	2.0	4.0	4.0	4.0	5.0
2	4.5	4.5	3.5	1.5	2.0	1.5	2.5	4.0
3	5.0	6.0	4.5	4.5	5.0	4.5	6.0	6.0
4	6.0	6.0	2.0	5.0	2.0	5.0	7.0	4.0
5	4.0	4.0	2.0	4.0	2.0	4.0	2.0	5.0
6	5.0	4.0	2.0	6.0	2.5	5.0	2.5	3.0
Total	28.5	29.5	18.5	23.0	17.5	24.0	24.0	27.0
Average	4.8	4.9	3.1	3.8	2.9	4.0	4.0	4.5
Roasted Oysters								
1	6.0	-	-	5.0	-	5.0	-	6.0
2	5.0	-	-	4.0	-	4.0	-	5.0
3	5.0	-	-	5.0	-	3.0	-	5.0
4	4.0	-	-	4.0	-	6.0	-	6.0
5	7.0	-	-	4.0	-	5.0	-	4.0
6	6.0	-	-	1.0	-	4.0	-	6.0
Total	33.0	-	-	23.0	-	27.0	-	32.0
Average	5.5	-	-	3.8	-	4.5	-	5.3

than 7 mg/l from the San Jacinto Monument to the Turning Basin. In the Turning Basin area and from the San Jacinto Monument to the Turning Basin, the DO criteria of 2.0 mg/l and 1.5 mg/l, respectively, for these reaches are being violated more than 85 percent of the time. Dissolved oxygen is generally less than 1.0 mg/l. The DO levels in the San Jacinto River tidal area are violated about 30 percent of the time.

In Galveston Bay west of the Ship Channel, the DO criterion of 5.0 mg/l is met about 95 percent of the time except near Morgan Point where the standard is being violated more than 35 percent of the time. Dissolved oxygen at this location is less than 4.0 mg/l at least 30 percent of the time.

The DO levels in the Trinity Bay area and West Bay east of Carancahua Reef meet the established DO criterion of 5.0 mg/l 95 percent of the time. The levels range from less than 2.0 mg/l to more than 15.0 mg/l in Trinity Bay and less than 3 mg/l to more than 10 mg/l in West Bay.

A criterion of 6.0 mg/l has been established for the remainder of the system. This level was met about 80 percent of the time, with values ranging from less than 4 mg/l to greater than 12 mg/l. The DO levels in the Gulf of Mexico must meet a criterion of 7.0 mg/l. Observed values in this zone range from 5.0 mg/l to more than 9 mg/l.

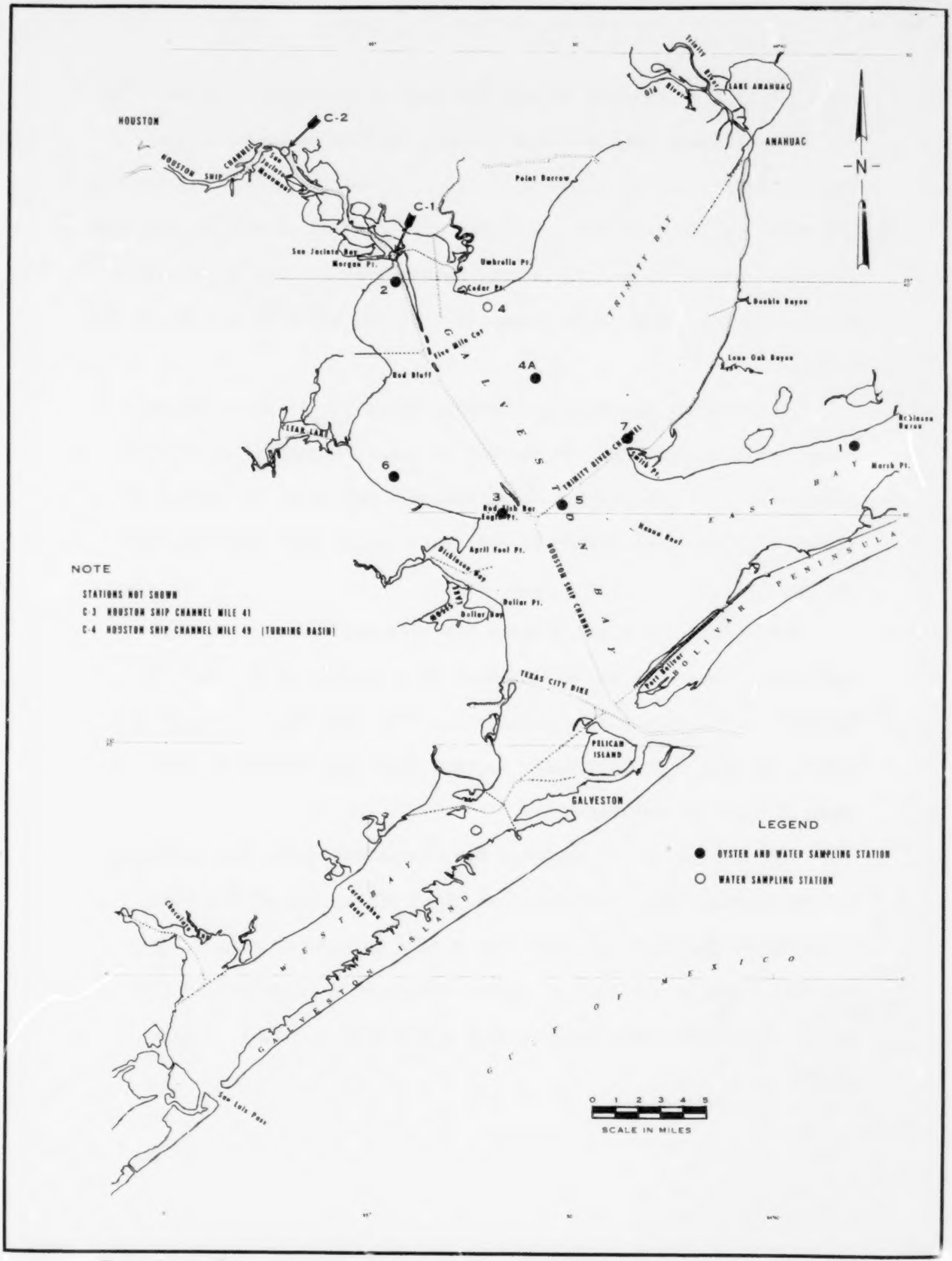
HOUSTON
C-2
HOUSTON SHIP CHANNEL
San Jacinto Monument
C-1
San Jacinto Bay
Morgan Pt.
Point Barrow
Umbrella Pt.
Cedar Pt.
2
4
4A
Five Mile Cut
Red Bluff
Clear Lake
6
3
Red Fish Bar
Eagle Pt.
5
7
TRINITY RIVER CHANNEL
Smith Pt.
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
TRINITY BAY
Double Bayou
Lone Oak Bayou
Robinson Bayou
1
Marsh Pt.
EAST BAY
Hanna Reef
GALVESTON BAY
HOUSTON SHIP CHANNEL
April Fool Pt.
Dickinson Bay
Moses Lake
Dollar Pt.
Dollar Bay
TEXAS CITY DIKE
Port Bolivar
BOLIVAR PENINSULA
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
N
NOTE
STATIONS NOT SHOWN
C-3 HOUSTON SHIP CHANNEL MILE 41
C-4 HOUSTON SHIP CHANNEL MILE 49 (TURNING BASIN)
LEGEND
● OYSTER AND WATER SAMPLING STATION
○ WATER SAMPLING STATION
0 1 2 3 4 5
SCALE IN MILES

Figure V - 11 Water and Oyster Sampling Locations - FWQA Reconnaissance Survey, November 1970

F. BIOCHEMICAL OXYGEN DEMAND

Biochemical oxygen demand (BOD) is a measure of the biologically oxidizable organic material in a wastewater. It theoretically represents the dissolved oxygen consumed by microbial life while assimilating and oxidizing the organics in the waste. The five-day BOD data collected by the Galveston Bay Study for the period July 1968 through June 1970 were evaluated for compliance with the Texas Water Quality Standards which specify BOD averages calculated over a one-year period.

In the Gulf of Mexico at Galveston the BOD criterion of 1.0 mg/l was exceeded 100 percent of the time with yearly averages ranging from 1.8 to 4.1 mg/l. Single BOD observations ranged from less than 1.0 mg/l to 13 mg/l in this zone.

The BOD criteria in the Houston Ship Channel are 7.0, 5.0 and 2.0 mg/l (yearly average) for various zones. These averages were exceeded 100 percent of the time with averages ranging from 4.6 mg/l to 20.8 mg/l. Single BOD observations ranged from 50 mg/l to less than 1.0 mg/l. The BOD criterion established for the Ship Channel from Morgan Point to the San Jacinto Monument (2.0 mg/l) is incongruous with the criteria set for immediately adjacent zones, i.e., Ship Channel to the Turning Basin (5.0 mg/l) and Galveston Bay west of the Ship Channel (6.0 mg/l). This is particularly apparent since BOD exceeds 6.0 mg/l from Morgan Point to the Monument 100 percent of the time although the applicable value is 2.0 mg/l.

A summary of BOD observations compared to required criteria in the remainder of the Galveston Bay system is presented in Table V-7.

The BOD parameter is not indicative of the actual organic pollution present, since the toxicity or growth limiting action of many of the industrial wastes entering Galveston Bay and its tributaries tends to inhibit oxidation of organic material. Depending upon the dilution employed, there was wide variation in BOD values observed in the same sample. This effect was most pronounced in samples collected from the Houston Ship Channel. Where the sample was undiluted, the BOD value was generally less than the BOD of a diluted sample - often by a factor of several hundred percent, thus indicating that toxic or growth inhibiting substances in the sample were preventing satisfaction of organic material. Biochemical oxygen demand is not a satisfactory indicator of the potential effect on water quality caused by most of the waste effluents discharged to the Galveston Bay system. This is particularly true of petrochemical effluents due to the large number of complex waste compounds not immediately susceptible to biological degradation.

TABLE V-7

COMPARISON OF BOD STANDARDS WITH OBSERVED AND AVERAGE VALUES

Zones	Criteria (Annual Average BOD) mg/1	Number Stations in Zone	Percent of Values Exceeding Criterion	Range of BOD Yearly Averages		Range of Single BOD Observation	
				High	Low	High	Low
East Bay	3.0	1	36.8	4.1	2.6	11	1
Galveston Bay East of Houston Ship Channel	4.0	3	23.2	5.3	2.3	12	1
Trinity Bay	5.0	4	32.4	7.2	2.9	19	1
Galveston Bay West of Houston Ship Channel	6.0	15	12.8	9.0	2.1	20	1
West Bay East of Carancahua Reef	3.0	1	18.8	4.5	1.9	14	0
West Bay West of Carancahua Reef	2.5	2	17.6	2.9	1.5	7	1

VI. WASTE SOURCES

The Texas Water Quality Board, in accordance with provisions of the Texas Water Quality Act of 1967, issues effluent permits to municipalities and industries. In the Galveston Bay area, permits have been issued to 141 municipal and domestic waste dischargers and 136 industrial waste dischargers. These discharges, the type of treatment provided, the quantities of waste effluent allowed under the permit, and the water pollution control needs where known, are listed in Tables VI-1 and VI-2. Little or no information is available on actual measurement and characterization of waste discharges.

The total permitted discharge of waste effluent to Galveston Bay and its tributaries, as of 1968, is approximately 779 million gallons per day (MGD) which may contain 583,000 pounds per day of suspended solids, 270,000 pounds per day of BOD, and 1,657,000 pounds per day of chemical oxygen demand (COD). The degree of necessary waste treatment to meet these requirements is not specified in the permits.

Of this total, 92.6 percent of the suspended solids, 85.5 percent of the BOD, and 92.8 percent of the COD are allocated to industrial sources while the remainder is applied to municipal or other domestic effluents. On a flow basis, industrial wastes contribute about 72 percent of the total. The distribution of permitted waste discharge by area is shown in Figures VI-1 through VI-4.

TABLE VI-1-A

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL ABOVE MORGAN POINT, INCLUDING BAYTOWN AREA[1/]

Source	Type of Treatment[2/]	PERMITTED DISCHARGE[3/] Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/Day	Waste Treatment Needs[4/] and Status
Baytown (Bayway Drive)	---	0.700	*117	*117	351	Unknown
Baytown, City of (Craigmont)	---	0.140	23	23	69	Unknown
Baytown, City of (East District)	Primary Chlorination	1.000	167	167	501	Unknown
Baytown, City of (Humble Docks)	Secondary Chlorination	0.560	93	93	279	Complies with permit.
Baytown, City of (West Main)	Secondary Chlorination	2.700	450	450	1,350	Complies with permit.
Beeler, R. F. (Sequoia Estates)	---	0.400	67	67	201	Unknown
Bellaire	None	1.950	325	325	1,075	Unknown
Chambers County (WCID #1)	Secondary Chlorination	0.030	5	6	18	Unknown
Crest Sanitary Corp.	Unknown	0.075	13	13	39	Unknown
Florence, R. G. (Port Haven)	Unknown	0.002	1	1	3	Unknown
Galco Utilities Co.	Unknown	0.108	18	18	54	Unknown
Galena Park (Plant #1)	Secondary No Chlor.	0.700	117	117	351	Unknown
Galena Park (Plant #2)	Secondary No Chlor.	0.100	17	17	**51	Enlarge existing plant.
Harris County (Estex Oaks District)	Secondary Chlorination	1.000	167	*167	501	Meets permit requirements. Houston has requested this plant be transferred to them.
Harris County (WCID-Fondren Road)	Unknown	0.650	108	108	324	Unknown
Harris County (FWSD #8)	Secondary Chlorination	0.700	117	117	351	Unknown
Harris County (FWSD #47)	Secondary Chlorination	0.600	100	100	300	Unknown
Harris County (FWSD #48-1)	---	0.220	37	37	111	Unknown
Harris County (FWSD #48-2)	---	0.210	35	35	105	Unknown
Harris County (FWSD #78)	---	0.100	17	17	51	Unknown
Harris County (WCID #1)	Secondary Chlorination	0.500	83	83	249	Unknown
Harris County (WCID #21)	Secondary Chlorination	0.850	142	142	426	In compliance. No needs.
Harris County (WCID #36)	Secondary Chlorination	0.350	58	58	174	No needs.
Harris County (WCID #69)	Secondary Chlorination	0.565	94	94	282	Plant remodeling required. Does not comply with permit.
Harris County (WCID #70-1)	---	0.050	7	7	21	Unknown
Harris County (WCID #70-2)	---	0.300	40	40	120	Unknown

TABLE VI-1-A (Continued)

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL ABOVE MORGAN POINT, INCLUDING BAYTOWN AREA[1]

Source	Type of Treatment[2]	PERMITTED DISCHARGE[3] Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/Day	Waste Treatment Needs[4] and Status
Harris County (WCID #73)	---	0.300	40	40	120	Unknown
Harris County (WCID #74)	Secondary Chlorination	0.250	42	42	126	Unknown
Harris County (WCID #78)	Unknown	0.150	20	20	60	Unknown
Harris County (WCID #84)	---	0.400	67	67	201	Unknown
Harris County (WCID #90)	Unknown	0.350	58	58	174	Unknown
Harris County (WCID #93)	Secondary Chlorination	0.700	117	117	351	Will connect to Houston treatment facilities.
Harris County (WCID #94)	Unknown	1.000	167	167	501	In compliance with permit 1970.
Harris County (WCID #95)	Secondary Chlorination	0.325	54	54	162	Unknown
Houston, City of (Water Treatment Plt.)	---	0.020	*3	*1	3	Unknown
Houston, City of (Almeda Plaza)	Secondary Chlorination	0.880	147	147	541	Enlarge existing plant.
Houston, City of (Chadwick Manor)	Secondary No Chlor.	0.056	9	9	27	Unknown
Houston, City of (Chatwood Plant)	Secondary Chlorination	0.276	127	101	303	Construct or improve outfall.
Houston, City of (Chocolate Bayou Plt.)	Secondary Chlorination	1.550	259	259	777	Meeting permit requirements.
Houston, City of (Clinton Park)	Secondary Chlorination	0.750	125	125	375	In compliance with permit.
Houston, City of (Cole Creek Manor)	Secondary Chlorination	0.300	50	50	150	Unknown
Houston, City of (Easthaven)	Unknown	0.214	36	36	108	Unknown
Houston, City of (Fontaine Place Subdivision)	Secondary Chlorination	0.280	163	135	405	Construction or improvement of outfall.
Houston, City of (Forest West)	Unknown	0.300	50	50	150	Unknown
Houston, City of (Gulf Palms Plt.)	Secondary No. Chlor.	0.180	95	48	144	Unknown
Houston, City of (Gulfway Terrace)	Secondary Chlorination	0.135	73	48	144	Unknown
Houston, City of (Harris Co. #34)	Secondary Chlorination	0.300	50	50	150	Unknown
Houston, City of (Internat'l. Arpt.)	---	0.200	33	33	**99	Unknown
Houston, City of (Lake Forest Plt.)	Secondary Chlorination	0.175	70	38	114	Unknown
Houston, City of (Longwood Subdivision)	Secondary Chlorination	0.021	4	4	12	Construction or improvement of outfall.
Houston, City of (New Homestead)	---	0.880	147	147	441	Currently meeting permit requirements.

TABLE VI-1-A (Continued)

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL ABOVE MORGAN POINT, INCLUDING BAYTOWN AREA[1/]

		PERMITTED DISCHARGE[3/]				
Source	Type of Treatment[2/]	Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/Day	Waste Treatment Needs[4/] and Status
Houston, City of (Northeast Dist.)	None	2.000	334	334	1,002	Construct secondary treatment plant.
Houston, City of (Northside Plt.)	Secondary No Chlor.	55.000	9,174	9,174	27,522	Not in compliance with permit.
Houston, City of (Northwest Plt.)	Unknown	4.000	673	673	2,019	Unknown
Houston, City of (Red Gully Plant)	---	0.300	50	50	150	Unknown
Houston, City of (Sims Bayou)	Secondary No Chlor.	48.000	8,006	8,006	24,018	Unknown
Houston, City of (Southwest Plant)	Secondary Chlorination	15.000	2,502	2,502	7,506	Enlarge existing plant.
Houston, City of (West Dist. Plt.)	Secondary Chlorination	6.000	1,002	1,002	3,006	Plant enlargement underway. Current quality in compliance.
Houston, City of (FWSD #23)	Secondary Chlorination	1.250	209	209	627	Enlarge plant. Construct or improve interceptors and outfalls.
Houston, City of (WCID #17)	---	0.750	494	125	375	Plant is to be enlarged to serve as a Regional Treatment System.
Houston, City of (WCID #20)	Secondary Chlorination	0.125	21	21	63	Construction or improvement of outfall.
Houston, City of (WCID #32)	Secondary Chlorination	0.750	125	125	375	Unknown
Houston, City of (WCID #34)	Secondary Chlorination	0.136	50	31	124	Unknown
Houston, City of (WCID #39)	Secondary Chlorination	0.522	305	135	405	Plant to be abandoned and flow diverted to another plant.
Houston, City of (WCID #42)	Secondary Chlorination	0.436	469	262	786	Unknown
Houston, City of (WCID #44-1)	Secondary Chlorination	0.250	261	200	600	Unknown
Houston, City of (WCID #44-2)	Secondary Chlorination	0.088	17	15	45	Unknown
Houston, City of (WCID #44-3)	Secondary Chlorination	0.700	490	403	1,209	Unknown
Houston, City of (WCID #47-1)	Secondary Chlorination	0.384	702	90	270	Construct or improve outfall.
Houston, City of (WCID #47-2)	Secondary Chlorination	0.384	160	86	258	Unknown
Houston, City of (WCID #51)	Secondary Chlorination	1.253	209	209	627	Unknown
Jacinto City	Secondary Chlorination	1.200	*320	320	960	Plant presently overloaded but meeting permit requirements.
Jersey Village	Unknown	0.066	11	11	33	Unknown
Jetro Lumber and Building Co.	---	0.012	2	2	6	Unknown
Katy, City of	Secondary Chlorination	0.280	*48	*48	144	Unknown
Mayflower Investment Company	---	0.500	83	83	249	Unknown

TABLE VI-1-A (Continued)

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL
ABOVE MORGAN POINT, INCLUDING BAYTOWN AREA 1/

Source	Type of Treatment 2/	PERMITTED DISCHARGE 3/ Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/Day	Waste Treatment Needs 4/ and Status
Memorial Villages Water Authority	Unknown	1.500	250	250	750	Plant currently meeting permit requirements.
Morgan Point, City of	---	0.100	17	17	51	Unknown
Nitsch, A. J. (Durkee Manor)	---	0.250	42	42	126	Unknown
Oak Glen Building Corp. (North Terrace)	---	0.300	40	40	120	Unknown
Oakwide Water Co.	Unknown	0.245	41	41	123	Unknown
Pace Setter, Inc. (Imp. Val.)	---	0.300	50	50	150	Unknown
Pasadena, City of (Deepwater Plant)	Secondary Chlorination	1.000	167	167	501	Unknown
Pasadena, City of (Northside Plant)	Secondary Chlorination	5.000	834	834	2,502	Not in compliance. Plant overloaded. Present volume 6.400 MGD.
Piney Point Village	Secondary No Chlor.	1.000	2,002	1,668	4,904	Unknown
Powell, C. L. (Nursing Home #2)	---	0.004	1	1	3	Unknown
Royalwood Municipal Utility District	Unknown	0.100	17	17	51	Unknown
Southern San. Corp.	---	0.350	58	58	174	Unknown
South Houston, City of	Secondary Chlorination	0.640	283	283	849	Enlarge existing plant.
Southside Place, City of	Secondary Chlorination	0.216	36	36	108	Unknown
Texas Highway Dept. (Interstate 10 Rest Stop)	---	0.010	2	2	6	Unknown
Turkey Creek Imp. District	Unknown	0.750	125	125	375	Unknown
Western Trails Prop., Inc.	Unknown	0.250	42	42	126	Unknown
West Road Imp. District	---	0.550	92	92	**276	In compliance with permit.
West University Place, City of	Secondary Chlorination	1.000	167	167	501	In compliance with permit.
White Oaks Develop. Co.	Unknown	0.050	7	7	21	Unknown
Young, Mrs. Mabel G.	---	0.098	16	16	48	Unknown

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* Estimated Value.

** True Value.

1/ Water Quality Standards for Zones 0904, 0905, and 0906 Apply - See Table V-1.

2/ Information from the FWQA STORET Inventory - Printout Date November 1970.

3/ Data from "Permitted Discharge Quantities - Buffalo Bayou and the Houston Ship Channel" compiled by FWQA, South Central Region.

4/ Information from FWQA STORET Inventory - Printout Date November 1970 and/or "Summary of Waste Discharges into the Houston Ship Channel in excess of 500,000 GPD." The latter document supplied by FWQA, South Central Region.

TABLE VI-1-B

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO GALVESTON BAY

Source	Type of Treatment[2]	PERMITTED DISCHARGE[3]				Waste Treatment Needs[4] and Status
		Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/Day	
Discharges to Galveston Bay or Tributaries. Morgan Point to Eagle Point (Includes Clear Lake Area) Zone 1104[1]						
Baycliff MUD	Secondary Chlorination	1.000	167	167	501	Unknown
Bayview MUD	Secondary Chlorination	0.250	42	42	126	Unknown
Clear Lake Utilities, Inc.	Unknown	0.250	42	42	126	Unknown
Clear Lake Water Authority	Secondary Chlorination	2.250	375	375	1,125	Unknown
Deer Park, City of -- South	Secondary Chlorination	0.700	117	117	351	Unknown
Ellington Air Force Base	Unknown	0.350	58	58	174	Unknown
Friendswood, City of	Secondary Chlorination	0.570	87	87	261	No needs.
Galveston County (WCID #12)	Unknown	0.425	71	71	213	Unknown
Harris County (Clear Woods Dist.)	Unknown	0.500	83	83	249	Unknown
Harris County (WCID #50)	Unknown	0.500	83	83	249	Unknown
Harris County (WCID #56)	Secondary Chlorination	0.580	97	97	291	Unknown
Harris County (WCID #75)	Secondary Chlorination	0.150	25	25	75	Unknown
Harris County (WCID #81)	Secondary Chlorination	0.250	42	42	126	Unknown
Harris County (WCID #83)	Secondary Chlorination	1.350	225	225	675	Unknown
Houston, City of (Gulf Meadows)	None	0.155	26	26	78	Enlarge Existing plant.
Houston, City of (Sagemont MUD)	Unknown	2.000	334	334	1,002	Unknown
Houston, City of (WCID #53)	Secondary Chlorination	0.368	61	61	183	Unknown
Houston, City of (WCID #62)	Secondary Chlorination	0.280	47	47	141	Unknown
Lagoon Utility Co.	Unknown	0.070	12	12	36	Unknown
La Porte, City of	Secondary Chlorination	0.723	121	121	363	No needs
League City	Secondary Chlorination	1.500	250	250	750	Unknown
Pasadena, City of (Golden Ac.)	Secondary Chlorination	0.400	67	67	201	Unknown
San Jacinto Jr. College	Unknown	0.128	21	21	63	Unknown
Seabrook, City of	Secondary Chlorination	2.500	417	417	1,251	No needs
Shoreacres, City of	Unknown	0.235	39	39	117	Unknown

TABLE VI-1-B (Continued)

MUNICIPAL AND DOMESTIC WASTE DISCHARGES TO GALVESTON BAY

Source	Type of Treatment[2/]	PERMITTED DISCHARGE[3/]				Waste Treatment Needs[4/] and Status
		Flow MGD	Susp. Solids #/Day	BOD #/Day	COD* #/day	
Webster, City of	Secondary Chlorination	0.400	67	67	201	No needs.
Discharges to Galveston Bay and Tributaries, Eagle Point to Galveston (includes Dickinson Bayou and Texas City) Zone 1104[1/]						
Galveston, City of (Airport)	Unknown	0.360	60	60	180	Unknown
Galveston, City of (Main Plant)	Unknown	6.400	1,068	1,068	3,204	Construct or improve interceptors, outfalls, and pumping station.
Galveston, City of (Teichman Point)	Unknown	0.050	8	8	24	Construct or improve interceptor.
Galveston, County (WCID #1)	Secondary No Chlor.	1.700	284	284	852	Unknown
Sunmeadow MUD	Unknown	0.014	2	2	6	Unknown
Texas City, City of	Secondary Chlorination	5.000	834	834	2,402	No needs.
Other Areas of Galveston Bay, Trinity Bay and Tributaries Zone 1103[1/]						
Anahuac, City of	None	0.404	67	67	201	Construction secondary plant, outfall, and pumping station.
Dayton, City of	Secondary Chlorination	0.553	92	92	276	Additional facilities required.
Liberty, City of	Secondary Chlorination	0.692	145	258	774	Unknown
Trinity Bay Cons. District	Unknown	0.400	53	53	159	Unknown
West Bay and Tributaries Zones 1105 & 1106[1/]						
Alvin, City of	Secondary Chlorination	3.750	626	626	1,878	Unknown
Brazoria County (WCID #4)	Unknown	0.160	27	27	81	Unknown
Fabulous Flamingo Isles	Unknown	0.200	33	33	99	Unknown
Galveston County (WCID #8)	Unknown	0.040	7	7	21	Unknown
Hitchcock, City of	Secondary Chlorination	0.300	50	50	150	Unknown
LaMarque, City of	Secondary Chlorination	1.900	555	317	1,551	Construction or improvement of outfall.
Oak Manor MUD	Unknown	0.050	8	8	24	Unknown
Robert E. Pine Utility Co.	Unknown	0.049	8	8	24	Unknown

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* Estimated values

1/ Water Quality Standards for this zone - See Table V-1.

2/ Information from the FWQA STORET Inventory - Printout Date November 1970.

3/ Data from "Permitted Discharge Quantities - Galveston Bay Area" compiled by FWQA South Central Region.

4/ Information from FWQA STORET Inventory - Printout Date November 1970 and/or "Summary of Waste Discharges into the Houston Ship Channel in excess of 500,000 GPD." The latter document supplied by FWQA, South Central Region.

TABLE VI-2-A

WASTE DISCHARGES FROM PETROLEUM, CHEMICAL, PLASTICS, AND RUBBER INDUSTRIES TO THE HOUSTON SHIP CHANNEL OR ITS TRIBUTARIES ABOVE MORGAN POINT INCLUDING THE BAYTOWN AREA[1]

	PERMITTED DISCHARGE[2]					
Name	Flow MGD	Oil & Grease mg/l	Susp. Solids #/day	BOD #/day	COD #/day	Waste Treatment Needs and Status[3]
Amerada Petroleum Corp.	0.028	--	*1	*1	*3	Unknown
Armour Agriculture Chemical Co.	0.664	--	2,011	*111	30	Unknown
Ashland Chemical Co. (Highland Chemical Co.)	1.380	20	806	575	2,302	Preaeration-sedimentation-temperature.
Atlantic Richfield Co. (11 outfalls)	8.950	4 to 135	5,355	9,347	*27,041	Biological treatment-domestic sewer hook-up to city to be completed 12/70.
Best Fertilizer Co.	0.007	10	4	1	9	Unknown
Celanese Plastic Co.	0.425	5	213	53	195	In compliance with permit requirements.
Cook Paint and Varnish Co.	0.080	Trace	4	*13	*39	Unknown
Crown Central Petrol. Corp. (4 outfalls)	1.600	10 to 90	2,834	3,686	11,058	Oil separation and biological treatment to be completed 1972.
Diamond Shamrock Corp. (7 outfalls)	0.500	--	*83	*83	*249	Biological treatment required.
Diamond Shamrock Corp. at Deer Park (6 outfalls)	149.250	10	124,474	35,458	211,044	Heavy Metal (Hg) removal, pH control, solids containment. Engineering underway.
Distillate Production Corp.	0.050	--	*8	*8	*24	Unknown
Dixie Chemical Co.	0.058	0.5	8	10	73	Unknown
Eddy Refining Co.**	0.001	0.3	1	1	1	Unknown
E. I. DuPont deNemours (2 outfalls)	4.312	20 15	1,257	1,795	7,192	Oil skimmer and aerated lagoon. Engineering in progress.
Enjay Chemical Co.	0.200	20	150	150	584	Unknown
Ethyl Corp. (2 outfalls)	26.000	3	4,337	4,337	6,505	Treatment facilities were modified to improve quality of effluent.
Goodyear Tire and Rubber Co. (Houston plant)	2.535	25	1,570	1,257	3,145	Settling and biological treatment. Lawsuit pending.
Gulf Oil Corp.	0.900	5	150	150	1,501	Unknown
Gulf States Asphalt Co., Inc.	0.150	5	25	13	50	Industry in compliance.
Hess Terminals	0.108	25	90	90	360	Unknown
Hooker Chemical Corp. (3 outfalls)	0.018	5	4	2	17	Unknown
Houston Natural Gas Corp.	1.340[3]	--	Unknown	Unknown	Unknown	Unknown
J. M. Huber Corp.	0.220	10	128	92	367	Unknown
Humble Oil and Refining Co.	25.000	20	14,595	10,425	41,700	Meeting permit requirements
Jefferson Lake Sulfur Co.	0.225	--	0	*1	*3	Unknown
Koppers Co., Inc.	0.008	20	3	3	13	Unknown
The Lubrizol Corp.** (2 outfalls)	1.000	25	834	834	3,336	Oil removal and biological treatment, solids disposal. Construction underway.
Marbon Chemical	0.090	4	2	1	15	No implementation schedule.
Merichem Company (Greens Bayou)	0.225	20	141	141	563	Not in compliance.
Murray Rubber Company	0.010	--	2	2	6	Unknown.

TABLE VI-2-A (Continued)

WASTE DISCHARGES FROM PETROLEUM, CHEMICAL, PLASTICS, AND RUBBER INDUSTRIES TO THE HOUSTON SHIP CHANNEL OR ITS TRIBUTARIES ABOVE MORGAN POINT INCLUDING THE BAYTOWN AREA1/

	PERMITTED DISCHARGE2/					
Name	Flow MGD	Oil & Grease mg/1	Susp. Solids #/day	BOD #/day	COD #/day	Waste Treatment Needs and Status3/
Olin Mathieson Chemical Corp.**	10.145		4,492	950	9,692	Additional oxidation ponds required. To be completed 1971.
Pennsalt Chemical Corp.	0.200	15	58	83	250	Unknown.
Petrolite Corp.-Petreco Corp.	0.002	20	1	1	1	Unknown
Petro Tex Chemical Corp.** (3 outfalls)	4.800	10 to 25	4,003	3,919	15,680	Aeration and solids removal equipment installed.
Phillips Petroleum Co. (Coast Res.)	0.090	--	*15	*15	*45	Unknown
Phillips Petroleum Co. at Pasadena (3 outfalls)	6.920	10	1,630	837	1,365	Sludge dewatering and biological oxidation. Work in progress.
Phosphate Chemicals, Inc. (2 outfalls)	0.455	20 5	218	190	1,897	Unknown
Plastic Applicators, Inc.	0.030	2.7	12	2	10	pH control, holding facilities and chemical treatment. In progress.
Premier Petrochemical Co.**	0.150	--	25	25	*75	pH control and NH_3 removal, addition of aeration required.
Reichhold Chemicals**	0.020	25	17	17	67	Solids and COD removal. No action.
Rohm and Haas Co.** (2 outfalls)	1.800	25	5,789	1,489	10,929	Operational problems with treatment facilities.
S and R Oil Co.	0.036	--	6	6	*18	Unknown
Shell Chemical Co. (2 outfalls)	6.100	25	15,262	5,087	50,874	Present plant overloaded. Expansion to be completed by 3/71.
Shell Oil Co.** (13 outfalls)	5.974	10 to 25	2,616	1,953	9,286	Effluent meets permit requirements.
Signal Oil and Gas Co. (2 outfalls)	2.880	25	1,801	1,201	9,608	Secondary treatment facilities near completion.
Sinclair-Koppers Chemical Co.	0.550	20	413	459	1,376	Company in compliance except for high COD.
Sinclair-Petrochemical, Inc.**	2.660	20	1,553	1,109	4,437	Unknown
Southwest Chemical & Plastic	0.004	14	1	1	2	Unknown
Stauffer Chemical Co.** (Greens Bayou) (2 outfalls)	1.165	10	486	194	194	Unknown
Stauffer Chemical Co.** (South of HSC)	1.000	25	417	167	667	Facilities for pH control near completion.
Superior Oil Co.	0.003	--	1	1	*3	Unknown
Tenneco Manufacturing Co.**	1.000	20	500	834	2,335	Effluent meets permit requirements.
Union Carbide, Linde Div.	0.144	20	60	24	120	Unknown
The Upjohn Co.**	0.580	15	339	242	967	Effluent in compliance with permit requirements.
Velsicol Chemical Corp.**	0.144	25	120	120	480	Unknown

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* Effluent toxic to bacteria - Information from the Houston Ship Channel Survey of Waste Effluents conducted in February 1969. FWQA South Central Region supplied data.

** Estimated values.

1/ Water Quality Standards for zones 0904, 0905, and 0906 apply - see Table V-1.

2/ Data from "Permitted Discharge Quantities - Buffalo Bayou and Houston Ship Channel" compiled by the FWQA, South Central Region.

3/ Data from (a) Summary of Waste Discharges into the Houston Ship Channel in excess of 500,000 GPD and/or (b) Summary of Industrial Waste Needs and/or (c) Summary of Industrial Facilities constructed and/or rehabilitated. The foregoing documents supplied by the FWQA, South Central Region.

TABLE VI-2-B

OTHER INDUSTRIAL DISCHARGES TO THE HOUSTON SHIP CHANNEL OR ITS TRIBUTARIES[1]

	PERMITTED DISCHARGES[2]					
Name	Flow MGD	Oil & Grease mg/l	Susp. Solids #/day	BOD #/day	COD #/day	Waste Treatment Needs and Status[3]
Airport Service Co.	0.004	15	1	1	*3	Unknown
Anchor Hocking Glass Corp.	0.028	15	5	5	50	Unknown
Armco Steel Corp.**	32.464	25	14,346	6,680	52,038	Unknown
Baker Oil Tools, Inc.	0.025	25	13	4	8	Unknown
Baroid Division-Nat. Lead Co.	0.503	10	84	63	627	Unknown
Big Three Weld Equipment Co.	0.007	--	*1	*1	*3	Unknown
Cameron Iron Works	0.036	50	44	*121	363	Unknown
Dresser Magcobar	0.006	5	1	1	10	Unknown
Dresser Systems, Inc.	0.105	--	18	18	*54	Unknown
Equity Export Corp.	0.002	5	1	1	1	Unknown
General Portland Cement Co.	0.500	--	209	4	24	Unknown
Grief Bros. Cooperage Co.	0.004	2	1	1	7	Unknown
Groendyke Transport	0.001	--	1	1	1	Unknown
Gulf Coast Portland Cement Co.	0.250	25	209	31	104	Unknown
Horton and Horton, Inc. (N. Live Oak)	0.003	--	80	1	*1	Unknown
Horton and Horton, Inc. (Pasadena)	0.001	--	27	*1	*3	Unknown
Houston Light and Power Co.**	0.004	0	1	1	3	Unknown
Houston Light and Power Co. (H. O. Clarke)	0.248	0	33	31	124	Unknown
Houston Light and Power Co. (Deepwater)(5 outfalls)	0.072	0	4,271	4,255	17,016	Unknown
Houston Light and Power Co. (Greens Bayou)	1.120	0	9	93	374	Unknown
Houston Light and Power Co. (T. H. Wharton)	4.800	0	200	240	1,001	Unknown
Hughes Tool Co. (5 outfalls)	0.990	15	143	122	591	Unknown
Ideal Cement Co.**	0.605	15	484	149	734	Effluent in compliance with permit requirements.
John Mecom and Proler Steel Corp.	0.007	--	1	1	*3	Unknown
Lead Products, Inc.	0.035	5	6	3	29	Unknown
Lone Star Cement Corp.	0.151	10	126	14	64	Unknown
Mission Manufacturing Co.	0.150	10	25	25	75	Unknown
National Bisquit Co.	0.002	5	1	1	2	Unknown
National Molasses Co.**	0.001	10	*1	*1	*3	Unknown
Nation Supply Div. Armco	0.112	15	14	19	140	Unknown
Parker Bros. and Co. (Clay Rd.)	0.002	--	*17	*1	*3	Unknown

TABLE VI-2-B (Continued)

OTHER INDUSTRIAL DISCHARGES TO
THE HOUSTON SHIP CHANNEL OR ITS TRIBUTARIES[1]

Name	PERMITTED DISCHARGE[2]					Waste Treatment Needs and Status[3]
	Flow MGD	Oil & Grease mg/1	Susp. Solids #/day	BOD #/day	COD #/day	
Parker Bros. and Co., Inc. (Main)	0.003	--	*1	*1	*3	Unknown
Parker Bros., Inc. (W. Park Plant)	0.001	--	*1	*1	*4	Unknown
Parker Bros. and Co. (Winfield)	0.001	--	*1	*1	*3	Unknown
Philip Carey Corp.	0.040	15	5	7	68	Unknown
Pittsburg Plate Glass Co.	0.160	15	13	13	53	Unknown
Rapid Transit Lines, Inc.	0.025	5	8	5	14	Unknown
Reddy Ice Division Southland Co.	0.014		1	1	1	Unknown
Reed Drilling Tools	0.722	25	482	361	2,108	Unknown
Reliance Universal, Inc.	0.007	1	1	--	2	Unknown
Shaw Tank Cleaning Co.	0.001	13	1	1	*3	Unknown
A. O. Smith Corp.**	0.850	25	425	354	1,418	Effluent meets permit requirements.
Smith-Douglas Co., Inc.	0.043	--	0	*7	*21	Unknown
Smith Industries, Inc.	0.007		*1	*1	*3	Unknown
SMS Industries	0.115	20	67	48	192	Aeration and solids removal. In progress.
Southern Pacific Co. (Englewood)	0.011	1	2	2	18	Unknown
Southern Pacific Railroad (Hardy St.)	0.016	15	5	3	27	Unknown
Southland Paper Mills #1	50.000	10	41,700	41,700	166,800	Solids and color removal. Engineering in progress.
Texas Instrument	0.645[3]		Unknown	Unknown	Unknown	Effluent complies with permit.
Todd Shipyards	0.008	--	*13	*13	*39	Unknown
Uncle Ben's Inc.	0.167	15	28	28	*84	Unknown
United States Gypsum** (2 outfalls)	0.500	25	417	417	1,668	Aerated lagoon and screening. To be in compliance 12/70.
U.S. Plywood - Champion Papers, Inc. (3 outfalls)	44.000	25	36,696	18,348	146,784	Required biological treatment being constructed.

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* Estimated values.

** Effluent toxic to bacteria - Information from the Houston Ship Channel Survey of Waste Effluents conducted in February 1969. FWQA, South Central Region supplied data.

[1] Water Quality Standards for Zones 0904, 0905, and 0906 apply - see Table V-1.

[2] Data from "Permitted Discharge Quantities - Buffalo Bayou and Houston Ship Channel" compiled by the FWQA, South Central Region.

[3] Data from (a) Summary of Waste Discharges into the Houston Ship Channel in excess of 500,000 GPD and/or (b) Summary of Industrial Waste Needs and/or (c) Summary of Industrial Facilities constructed and/or rehabilitated. The foregoing documents supplied by the FWQA, South Central Region.

TABLE VI-2-C

WASTE DISCHARGES FROM PETROLEUM, CHEMICAL, PLASTICS, AND RUBBER INDUSTRIES TO GALVESTON BAY OR ITS TRIBUTARIES

Name	PERMITTED DISCHARGE[2]					Waste Treatment Needs and Status[3]
	Flow MGD	Oil & Grease mg/1	Susp. Solids #/day	BOD #/day	COD #/day	
Discharges to Galveston Bay or Tributaries - Morgan Point to Eagle Point (includes Clear Lake Area) Zone 1104[1]						
Chemetron Chems.	0.144	2	24	24	96	Meets permit requirements.
Humble Oil and Refinery Co. (Bayport)	0.010	--	2	2	*6	Unknown
Humble Oil and Refinery Co. (Bayport)	9.000		5,292	1,501	15,012	Activated sludge, stabilization basins and aerobic digestion. Construction plans in progress.
Humble Oil and Refinery Co. (Clear Lake)	0.008	--	1	1	*3	Unknown
Lowe Chemical Co.	0.726	--	0	*121	*363	Unknown
Pan American Petroleum Corp.	0.012	--	1	1	*3	Unknown
Retzloff Chemical Co.	0.010	--	2	2	*6	Unknown
Southeast Chemical and Plastic Co.	0.043	--	4	6	*18	Unknown
Discharges to Galveston Bay or Tributaries (Eagle Point to Galveston) (includes Dickinson Bayou and Texas City) Zone 1104[1]						
American Oil Co. at Texas City	13.000	--	3,686	9,649	*28,947	Need extended aeration. Discharge over permit.
Amoco Chemical Corp. (Plant A)	0.370	20	216	154	617	Unknown
The Borden Chemical Corp. near Texas City	0.030	--	8	*4	*29	Need pH control and PO_4 removal.
Chem. Industries Corp.	0.002	--	1	1	*3	Unknown
General Analine and Film Corp. Texas City plant	1.000[3]	--	Unknown	Unknown	Unknown	Aeration and in-plant controls. Present discharge over permit.
Humble Oil and Refinery Co. (Dickinson)	0.003	--	1	1	*3	Unknown
Marathon Oil Co. at Texas City	1.156	25	*1,186	405	1,591	H_2S Stripper and biological treatment.
Mineral Oil Refinery Co.	0.082	--	34	34	*102	Unknown
Monsanto Chemical Co. at Texas City	106.000	--	*224,004	*8,397	*569,589	Oil skimming, clarification, biologically inert plastic pallets spearation.
Pan American Pet. Corp.	0.035	4	6	1	3	Unknown
Texas City Refining Co.	1.440	20	0	973	1,441	Discharge over permit. Biological phenols and flouride removal - in progress.
Union Carbide Chemical Co. at Texas City	10.196	--	4,936	46,291	84,181	Discharge over permit. Construction of treatment facility in progress.
Discharges to Other Areas of Galveston Bay, Trinity Bay or Tributaries Zone 1103[1]						
Texas Gulf Sulfur (Moss Bluff)	4.541	--	*751	*751	*2,251	Unknown
West Bay or Tributaries Zones 1105 and 1106)[1]						
Monsanto Chem. Co. (Chocolate Bayou)	2.900		726	726	*2,178	Increased Biological Capacity required.
Phillips Petroleum Co. (Bayou)	0.437	--	*73	73	*219	Unknown

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* Estimated values.

[1] See Table V-1 for applicable water quality standards in this zone.

[2] Data from "Permitted Discharge Quantities - Galveston Bay Area," compiled by the FWQA, South Central Region.

[3] Data from (a) Summary of Industrial Waste Needs and/or (b) Summary of Industrial Facilities Constructed and/or Rehabilitated. The foregoing documents supplied by the FWQA, South Central Region.

TABLE VI-2-D

OTHER INDUSTRIAL DISCHARGES TO GALVESTON BAY OR ITS TRIBUTARIES

	Permitted Discharge 2/					
Name	Flow MGD	Oil & Grease mg/1	Susp. Solids #/day	BOD #/day	COD #/day	Waste Treatment Needs and Status 3/
Discharges to Texas City, Galveston and Dickinson Bayou Areas - Zone 1104 1/						
Atchison, Topeka, & Santa Fe Railroad #1	0.004	20	*7	*7	*21	Unknown
Atchison, Topeka, & Santa Fe Railroad #2	0.002	0.0	*3	*3	*9	Unknown
Malone Service Co.	0.010	-	*42	*0	*6	Completely retained.
Texas City Terminal Railroad	0.003	-	1	1	*3	Unknown
Todd Shipyards Corp.	0.032	-	*53	*53	*159	Unknown
Wah Chang Corporation	0.110	-	43	2	11	Chemical treatment and pH control. No compliance date set.
Discharges to West Bay Area Zone 1105 1/						
McGinnes Industries Main Co.	1.000	-	584	417	1,668	Unknown

* Estimated values

1/ See Table V-1 for applicable water quality standards in this zone.

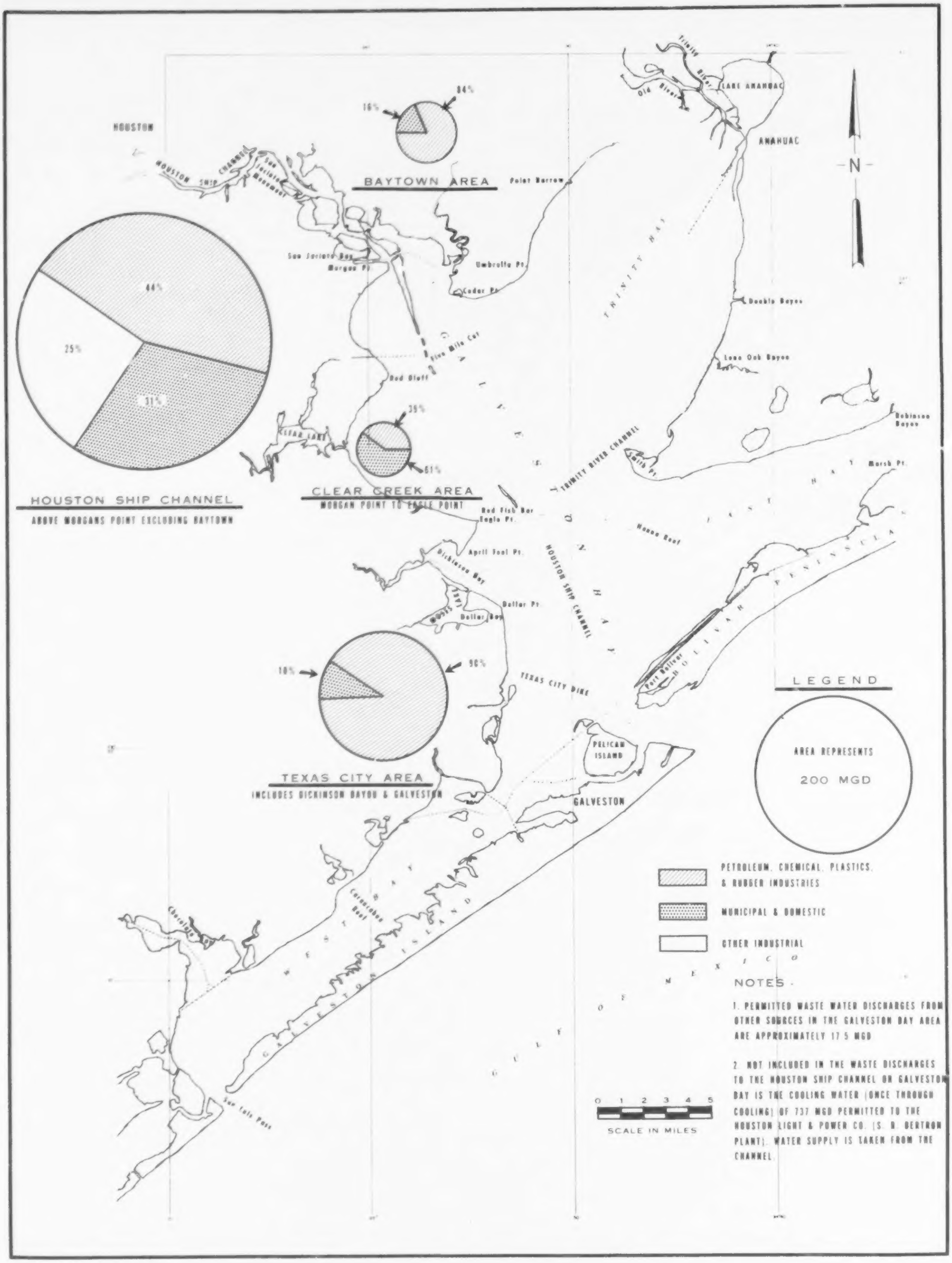
2/ Data from "Permitted Discharge Quantities-Galveston Bay Tributaries", compiled by the FWQA, South Central Region.

3/ Data from (a) Summary of Industrial Waste Needs and/or (b) Summary of Industrial Facilities Constructed and/or Rehabilitated. The foregoing documents supplied by the FWQA, South Central Region.

A. MUNICIPAL AND DOMESTIC WASTE DISCHARGES

Municipal and domestic waste sources are permitted to discharge over 215 MGD containing 39,400 pounds per day of suspended solids, 39,300 pounds per day of BOD and 118,900 pounds per day of COD. The areas where most of this waste is discharged are the Houston Ship Channel and tributaries, Clear Lake, and the Texas City, Galveston, and Dickinson Bayou areas. The Houston Ship Channel area has 90 sources discharging about 172 MGD with 31,500 pounds per day of suspended solids, 31,300 pounds per day of BOD, and 95,200 pounds per day of COD. This represents 80 percent of the waste effluent permitted from domestic sources in Galveston Bay. Clear Lake with 26 sources and Texas City-Galveston-Dickinson Bayou with six sources, discharge 7.5 percent, and 5.6 percent of the total, respectively. The remaining 7 percent is discharged from the Baytown, Trinity Bay, and West Bay areas.

Nearly 144 MGD is discharged from 37 treatment plants by the city of Houston to the Houston Ship Channel or its tributaries. Only eight of these plants have flows greater than one MGD. The two major installations are the Northside plant at 55 MGD and the Sims Bayou plant with 48 MGD. It has previously been demonstrated that the Houston Ship Channel is the major source of coliform pollution contaminating shellfish harvesting areas in Galveston Bay. Most of the permits for municipal sources require disinfection of wastes by chlorination. Neither the Northside nor Sims Bayou plants have chlorination facilities as of January 1971.

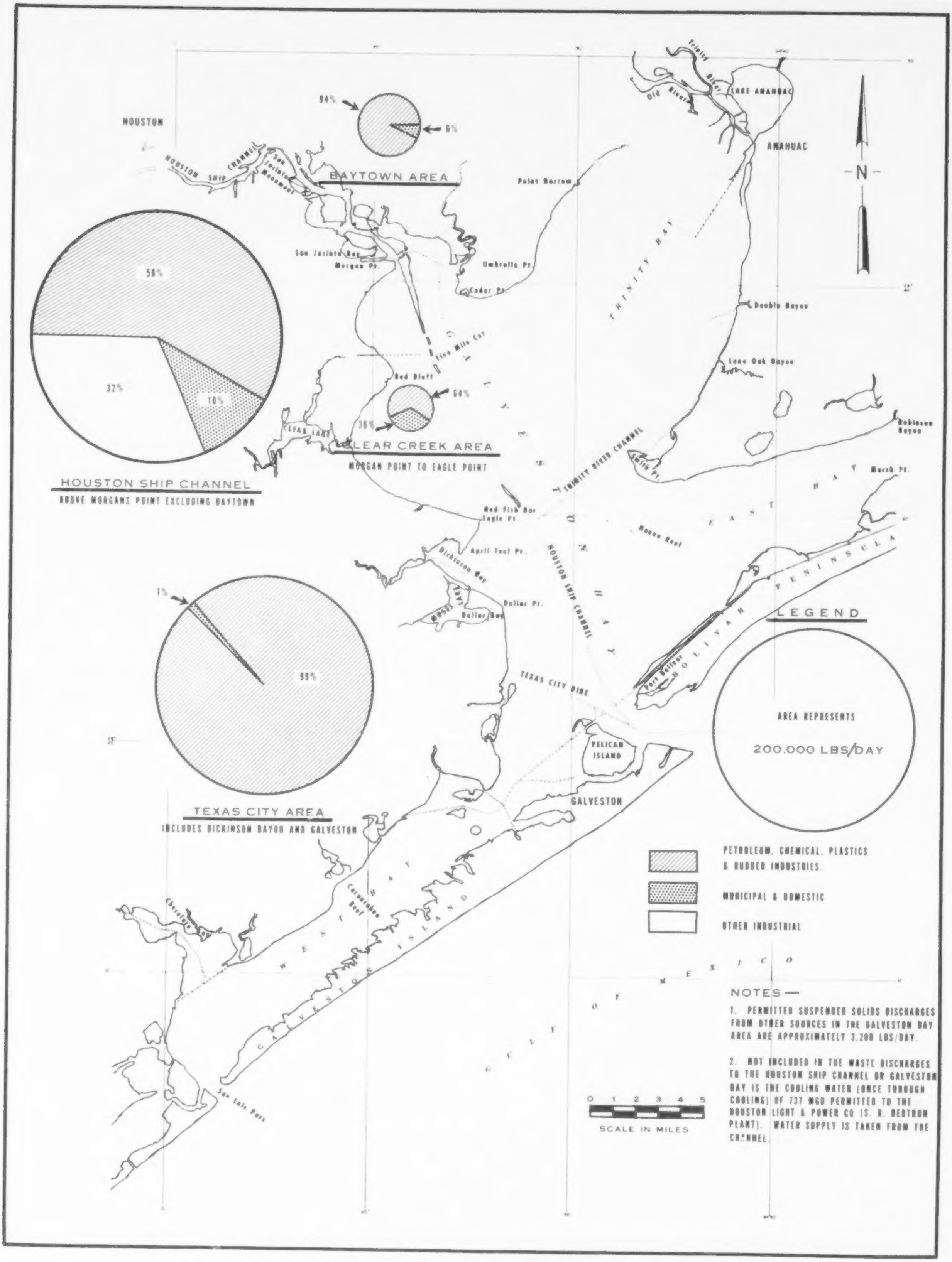

HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
BAYTOWN AREA
16%
84%
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
N
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
TRINITY BAY
Double Bayou
Five Mile Cut
Red Bluff
Lone Oak Bayou
44%
25%
31%
39%
61%
CLEAR LAKE
Robinson Bayou
TRINITY RIVER CHANNEL
Smith Pt.
Marsh Pt.
HOUSTON SHIP CHANNEL
ABOVE MORGANS POINT EXCLUDING BAYTOWN
CLEAR CREEK AREA
MORGAN POINT TO EAGLE POINT
Red Fish Bar
Eagle Pt.
GALVESTON BAY
EAST BAY
Hanna Reef
April Fool Pt.
Dickinson Bay
HOUSTON SHIP CHANNEL
Dollar Pt.
Dollar Bay
BOLIVAR PENINSULA
10%
90%
Port Bolivar
TEXAS CITY DIKE
LEGEND
PELICAN ISLAND
AREA REPRESENTS
200 MGD
TEXAS CITY AREA
INCLUDES DICKINSON BAYOU & GALVESTON
GALVESTON
PETROLEUM, CHEMICAL, PLASTICS, & RUBBER INDUSTRIES
MUNICIPAL & DOMESTIC
OTHER INDUSTRIAL
WEST BAY
Carancahua Reef
GALVESTON ISLAND
Chocolate Bay
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

NOTES:

1. PERMITTED WASTE WATER DISCHARGES FROM OTHER SOURCES IN THE GALVESTON BAY AREA ARE APPROXIMATELY 17.5 MGD

2. NOT INCLUDED IN THE WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL OR GALVESTON BAY IS THE COOLING WATER (ONCE THROUGH COOLING) OF 737 MGD PERMITTED TO THE HOUSTON LIGHT & POWER CO. (S. R. BERTRON PLANT). WATER SUPPLY IS TAKEN FROM THE CHANNEL.

Figure VI-1 Permitted Wastewater Discharges in the Galveston Bay Area

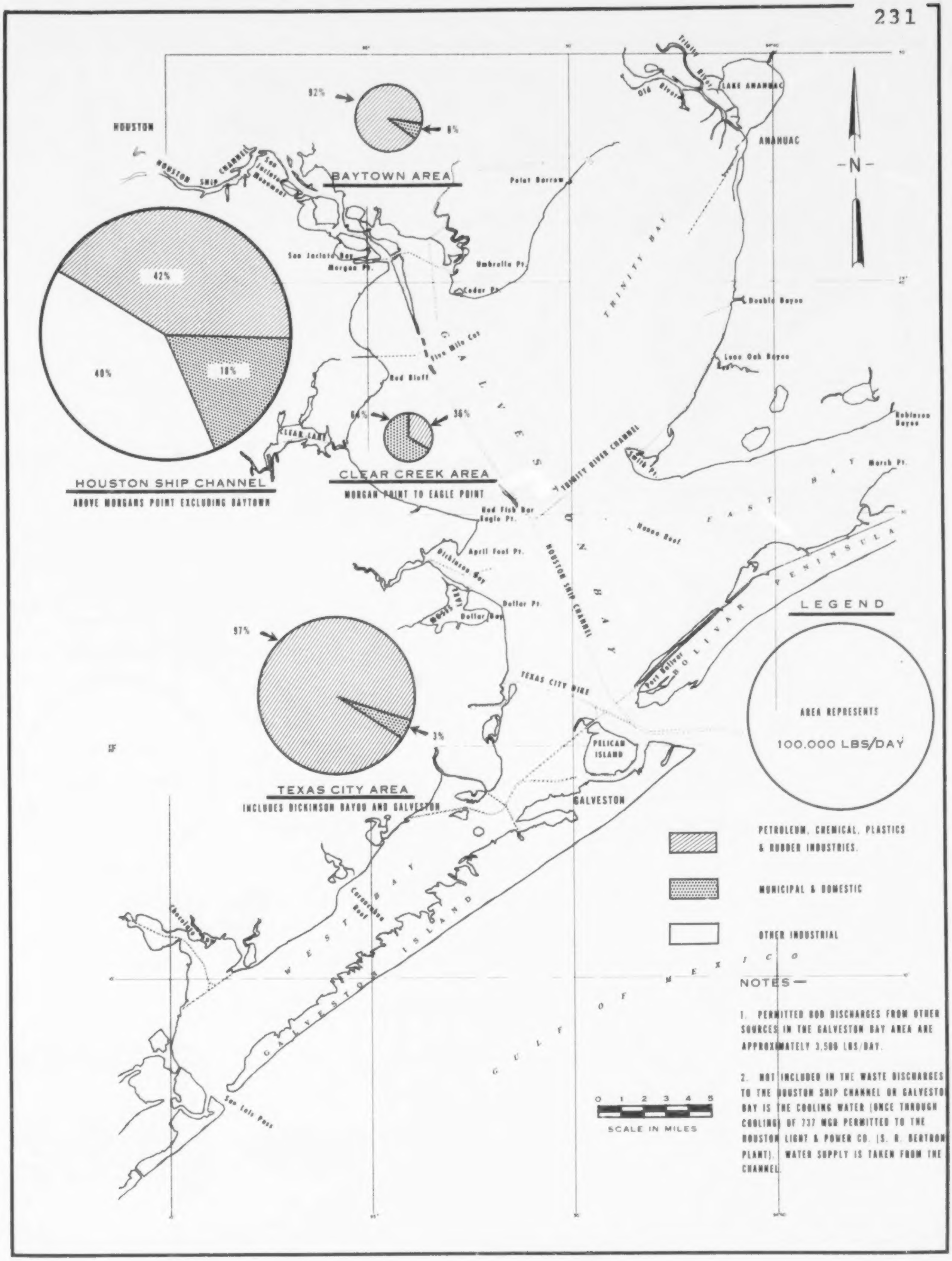

HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
94%
6%
BAYTOWN AREA
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
-N-
TRINITY BAY
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
58%
32%
10%
Five Mile Cut
Red Bluff
64%
36%
Double Bayou
Lone Oak Bayou
CLEAR LAKE
CLEAR CREEK AREA
MORGAN POINT TO EAGLE POINT
HOUSTON SHIP CHANNEL
ABOVE MORGANS POINT EXCLUDING BAYTOWN
TRINITY RIVER CHANNEL
Smith Pt.
Robinson Bayou
Marsh Pt.
EAST BAY
GALVESTON BAY
Red Fish Bar
Eagle Pt.
Moses Reef
April Fool Pt.
Dickinson Bay
Moses Lake
Dollar Bay
Dollar Pt.
HOUSTON SHIP CHANNEL
1%
99%
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
TEXAS CITY AREA
INCLUDES DICKINSON BAYOU AND GALVESTON
LEGEND
AREA REPRESENTS
200,000 LBS/DAY
PETROLEUM, CHEMICAL, PLASTICS & RUBBER INDUSTRIES.
MUNICIPAL & DOMESTIC
OTHER INDUSTRIAL
WEST BAY
Carancahua Reef
GALVESTON ISLAND
Chocolate Bay
San Luis Pass
GULF OF MEXICO
0 1 2 3 4 5
SCALE IN MILES

NOTES—

1. PERMITTED SUSPENDED SOLIDS DISCHARGES FROM OTHER SOURCES IN THE GALVESTON BAY AREA ARE APPROXIMATELY 3,200 LBS/DAY.

2. NOT INCLUDED IN THE WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL OR GALVESTON BAY IS THE COOLING WATER (ONCE THROUGH COOLING) OF 737 MGD PERMITTED TO THE HOUSTON LIGHT & POWER CO (S. R. BERTRON PLANT). WATER SUPPLY IS TAKEN FROM THE CHANNEL.

Figure VI-2 Permitted Suspended Solids Discharges in Galveston Bay Area

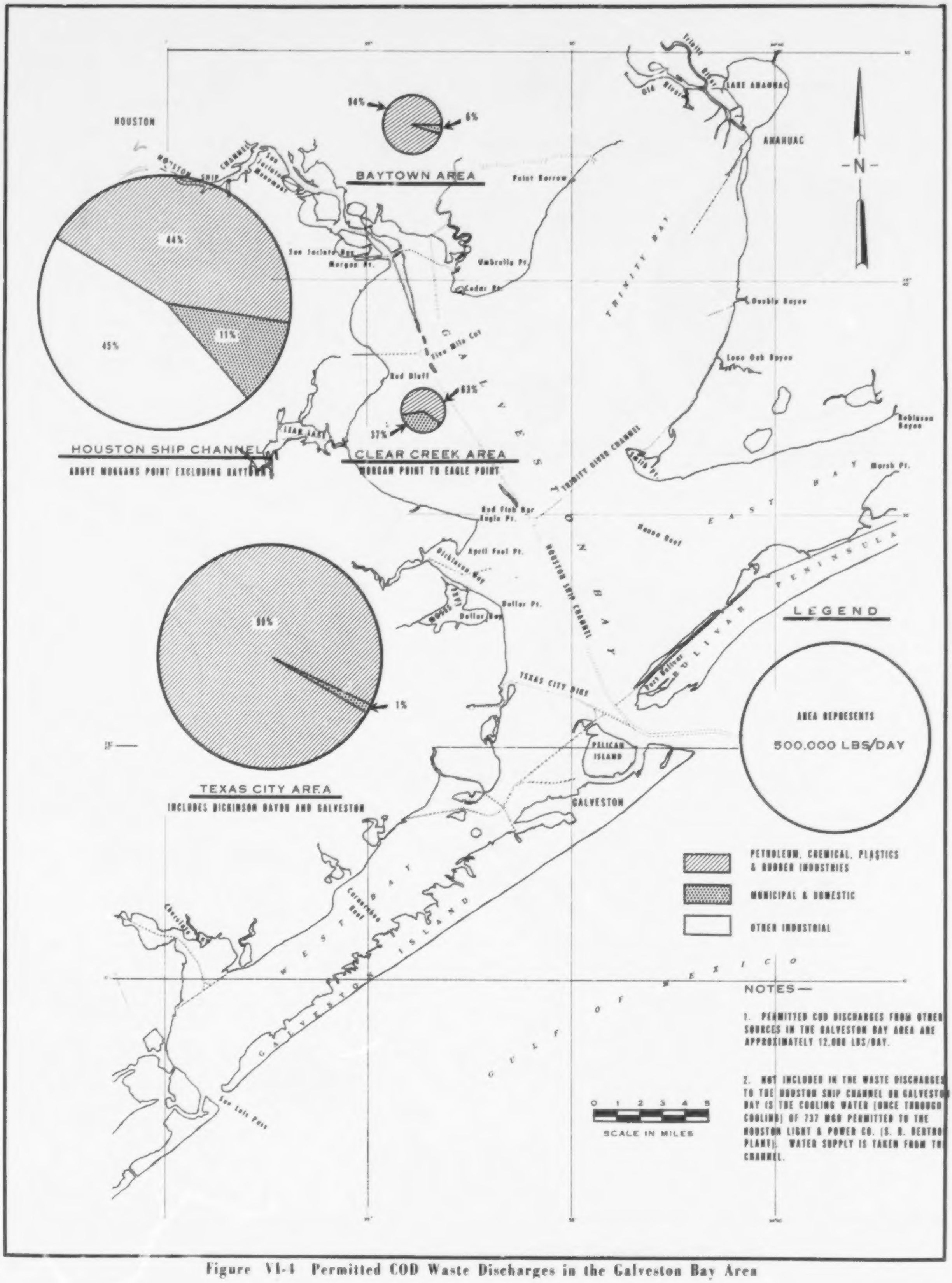

HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
92%
8%
BAYTOWN AREA
42%
18%
40%
HOUSTON SHIP CHANNEL
ABOVE MORGANS POINT EXCLUDING BAYTOWN
64%
36%
CLEAR CREEK AREA
MORGAN POINT TO EAGLE POINT
97%
3%
TEXAS CITY AREA
INCLUDES DICKINSON BAYOU AND GALVESTON
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
N
Point Barrow
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
TRINITY BAY
Double Bayou
Lone Oak Bayou
Five Mile Cut
Red Bluff
CLEAR LAKE
GALVESTON BAY
TRINITY RIVER CHANNEL
Smith Pt.
Robinson Bayou
Marsh Pt.
EAST BAY
Red Fish Bar
Eagle Pt.
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
LEGEND
AREA REPRESENTS
100,000 LBS/DAY
PETROLEUM, CHEMICAL, PLASTICS & RUBBER INDUSTRIES.
MUNICIPAL & DOMESTIC
OTHER INDUSTRIAL
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

NOTES—

1. PERMITTED BOD DISCHARGES FROM OTHER SOURCES IN THE GALVESTON BAY AREA ARE APPROXIMATELY 3,500 LBS/DAY.

2. NOT INCLUDED IN THE WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL OR GALVESTON BAY IS THE COOLING WATER (ONCE THROUGH COOLING) OF 737 MGD PERMITTED TO THE HOUSTON LIGHT & POWER CO. (S. R. BERTRON PLANT). WATER SUPPLY IS TAKEN FROM THE CHANNEL.

Figure VI-3 Permitted BOD Waste Discharges in the Galveston Bay Area


HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
94%
6%
BAYTOWN AREA
Point Barrow
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
-N-
44%
11%
45%
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
TRINITY BAY
Double Bayou
Five Mile Cut
Red Bluff
Lone Oak Bayou
63%
37%
Robinson Bayou
HOUSTON SHIP CHANNEL
ABOVE MORGANS POINT EXCLUDING BAYTOWN
CLEAR LAKE
CLEAR CREEK AREA
MORGAN POINT TO EAGLE POINT
TRINITY RIVER CHANNEL
Smith Pt.
Marsh Pt.
EAST BAY
Red Fish Bar
Eagle Pt.
GALVESTON BAY
Hanna Reef
April Fool Pt.
Dickinson Bay
HOUSTON SHIP CHANNEL
99%
Dollar Pt.
Dollar Bay
BOLIVAR PENINSULA
Port Bolivar
LEGEND
TEXAS CITY DIKE
1%
AREA REPRESENTS
500,000 LBS/DAY
PELICAN ISLAND
TEXAS CITY AREA
INCLUDES DICKINSON BAYOU AND GALVESTON
GALVESTON
▨ PETROLEUM, CHEMICAL, PLASTICS & RUBBER INDUSTRIES
▒ MUNICIPAL & DOMESTIC
☐ OTHER INDUSTRIAL
Confederate Reef
WEST BAY
GALVESTON ISLAND
Chocolate Bay
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

NOTES—

1. PERMITTED COD DISCHARGES FROM OTHER SOURCES IN THE GALVESTON BAY AREA ARE APPROXIMATELY 12,000 LBS/DAY.

2. NOT INCLUDED IN THE WASTE DISCHARGES TO THE HOUSTON SHIP CHANNEL OR GALVESTON BAY IS THE COOLING WATER (ONCE THROUGH COOLING) OF 737 MGD PERMITTED TO THE HOUSTON LIGHT & POWER CO. (S. R. BERTRO PLANT). WATER SUPPLY IS TAKEN FROM TH CHANNEL.

Figure VI-4 Permitted COD Waste Discharges in the Galveston Bay Area

Effluent data collected by the Texas Water Quality Board February 1969 showed total coliform concentrations at both plants to be 34,800,000/100 ml. Fecal coliform concentrations were 13,000,000/100 ml and 3,300,000/100 ml at the Northside and Sims Bayou plants, respectively.

At least 4 MGD of domestic wastes is being discharged to the Galveston Bay system with no treatment. Harris County Sewer Districts discharge waste from 27 sources, only one of which has a flow of one MGD. The City of Houston has four additional sources not discharging to the Ship Channel, for a total of 41. Galveston has three sources and Baytown has five. More than 110 MGD of raw, inadequately treated, or unchlorinated sewage is discharged to Galveston Bay. The multiplicity of waste treatment plants constructed by each political subdivision is wasteful of resources and does not provide adequate operations to assure the best treatment for domestic sewage. A program of centralization of treatment facilities and abandonment of small plants, with a firm implementation schedule, should be undertaken at the earliest time. Effective year round chlorination should be initiated immediately for all existing domestic effluents.

B. INDUSTRIAL WASTE DISCHARGES

The 136 industrial waste dischargers are permitted a total effluent of about 563 MGD containing 540,000 pounds per day of suspended solids, 230,300 pounds per day of BOD, and 1,538,200 pounds per day of COD. Petroleum and related industries, amounting to 75 sources, account for 81 percent of the suspended solids permitted, 68 percent of the BOD, and 74.5 percent of the COD.

The Houston Ship Channel receives the major portion of industrial waste discharges to the Galveston Bay system. The permitted waste effluent totals are about equally divided between petroleum and related industries with 48 sources and other industries amounting to 53 sources. The Houston Ship Channel may receive 283,500 pounds per day of suspended solids, 149,500 pounds per day of BOD, and 783,900 pounds per day of COD. The major sources of waste discharged to the Ship Channel are the Diamond Shamrock Company at Deer Park with more than 149 MGD, Ethyl Corporation with 26 MGD, Humble Oil and Refining Company with 25 MGD, Armco Steel Corporation with 32.5 MGD, U.S. Plywood-Champion Paper Company with 44 MGD, and Southland Paper Mills with 50 MGD. Of the total 101 industrial sources permitted to discharge wastes to the Houston Ship Channel, these six effluents account for 83 percent of the suspended solids, 78 percent of the BOD, and 79 percent of the COD. Three of these sources, Diamond Shamrock, U.S. Plywood-Champion Paper, and Southland Paper Mills account for 72 percent, 64 percent, and 67 percent of the total amount of suspended solids, BOD, and COD, respectively, discharged daily to the Houston Ship Channel. Diamond Shamrock discharges heavy metals, particularly mercury, without adequate treatment. There is also a need for pH control and solids containment at this plant. Armco Steel Corporation has been discharging phenols and cyanide, an extremely toxic substance. Adequate treatment is not provided at Southland Paper Mills. Excessive color is a constituent of the waste effluent from both U.S. Plywood-Champion Paper and Southland Paper Mills. U.S. Plywood-Champion Paper is now completing secondary treatment facilities. The treatment at Ethyl consists of an oyster shale barrier for pH control and an oxidation pond. Humble Oil at Baytown has aerated lagoons and is said to be in compliance with permit requirements.

Although the Texas permits specify that 180,800 pounds per day of BOD may be discharged from municipal and industrial sources to the Houston Ship Channel, studies conducted in the Channel during 1968 and 1969 indicate that as much as 363,000 pounds per day of five day BOD is the actual loading[1/]. The aggregate total of waste discharges is in substantial noncompliance with the Texas Water Quality Board permits. To meet the requirements of the Texas Water Quality Board, a 50 percent reduction of wastes discharged to the Channel is mandatory in addition to any reductions already accomplished. The conclusion of the study cited indicates that, even if the requirements of the permits are met, the dissolved oxygen criterion of 2 mg/l, established in the Texas Water Quality Requirements for the most polluted section of the Ship Channel, will continue to be violated. Approximately 90 percent additional

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[1/] Kramer, G. R., R. W. Hann, and S. B. Carpenter, "Completely Mixed Model of the Houston Ship Channel", Estuarine Systems Projects, Technical Report No. 11, Environmental Engineering Division, Texas A&M University.

treatment of wastes is needed to maintain a dissolved oxygen level of 2.0 mg/1. These studies were based on BOD loadings and did not account for any long-term or second stage oxygen demands. Under these circumstances, and since it has been demonstrated that BOD does not adequately characterize the oxygen demanding effects of wastes discharged to the Galveston Bay system due to the discharge of toxic or growth inhibiting substances in the waste effluents, the estimate of 90 percent additional treatment is conservative. It is probable that greater than 90 percent additional treatment will be required to meet the applicable receiving water criteria. The Texas discharge permits should be revised such that effluent discharges are consistent with established water quality standards.

The permits allow the discharge of 315,000 pounds per day of suspended solids to the Ship Channel. Materials dredged from the Ship Channel contain substantial quantities of organic sludges, oil, and other pollutants characteristic of wastes discharged to the Channel. About one-third of the BOD loading and one-half of the suspended solids discharged settle out and are incorporated in the bottom sediments[2/]. These waste materials contribute a substantial portion of the sediments which must periodically be removed by dredging. The total project cost for dredging the Houston Ship Channel in 1970 incurred by the U.S. Army Corps of Engineers is

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2/ Hutton, W. S., R. W. Hann, and R. H. Smith, "A Quantitative and Qualitative Survey of Benthal Deposits Contained in the Houston Ship Channel", Estuarine Systems Projects, Technical Report No. 8, Texas A&M University, May 1970.

$2,807,000. The disposal of this highly organic spoil may cause water quality problems through dispersion of pollutants and through exercise of oxygen demand from the volatile material contained. The additional costs incurred by the Corps of Engineers for dredging of the Houston Ship Channel and the effect on water quality due to disposal of the organic sludge should be evaluated. Recommendations made as a result of this evaluation should include an assessment of damages among the waste dischargers to the Channel and location of suitable spoil disposal areas to minimize or eliminate deleterious effects on water quality.

The other major area of industrial waste discharge to the Galveston Bay system is at Texas City-Dickinson Bayou. There are 17 sources of waste in the area; however, the discharge from the six non-petroleum related sources is negligible. The 11 petroleum related sources are permitted to discharge 234,000 pounds per day of suspended solids, 65,900 pounds per day of BOD, and 686,500 pounds per day of COD. Of this total, the Monsanto Chemical Company at Texas City with 106 MGD contributes the overwhelming majority of the pollution discharged. Suspended solids and COD discharges permitted from Monsanto account for 96 percent and 83 percent, respectively, of the total from the area. Monsanto is not providing adequate waste treatment. An assessment of waste treatment needs for Monsanto includes oil skimming devices, clarification and separation of biologically inert plastics. The major source of BOD waste in the area is the Union Carbide Chemical Company at Texas City with 10.2 MGD. Union Carbide is permitted to discharge 70 percent of the total BOD load in this area. Currently, the waste discharge is in non-compliance with the permit. American Oil Company at Texas City with 13 MGD is also a major waste discharger. The effluent is not in compliance with the permit.

Texas Gulf Sulfur Company at Moss Bluff discharges 4.5 MGD to the Trinity Bay area. The status of treatment is not known. The Monsanto Chemical Company at Chocolate Bayou discharges 2.9 MGD in the West Bay area. The treatment provided is inadequate.

Although the Texas Water Quality Standards state that receiving waters shall be "substantially free" of oil, the permits issued by the Texas Water Quality Board allow more than 55,000 pounds per day of oil and grease to be discharged from 81 sources into Galveston Bay and its tributaries. Seventy-four of these sources are located on the Houston Ship Channel, accounting for 98 percent of the total permitted discharge. The major sources of oil discharge are: Diamond Shamrock Corporation at Deer Park, 12,500 pounds per day; U.S. Plywood-Champion Papers Company, 9,200 pounds per day; Armco Steel Company, 6,800 pounds per day; Atlantic Richfield Company, 8,100 pounds per day; Humble Oil and Refining Company, 4,200 pounds per day; and Southland Paper Mills, 4,170 pounds per day. Shell Chemical Company and Crown Central Petroleum Company may discharge 1,270 and 1,200 pounds per day, respectively. These eight sources account for 86 percent of the permitted discharges.

Excessive concentrations of oil and petrochemical residues have been found in oysters taken from Galveston Bay. The Texas permits should be amended to allow no discharge of oil and grease from any waste source. The permitted discharge of oil from these waste sources constitutes violation of Section 11(b) of the Federal Water Pollution Control Act, as amended.

The petrochemical and related industries constitute the major pollution dischargers to Galveston Bay and its tributaries. Discharge permits specify suspended solids, BOD and COD. These parameters are not adequate to measure the water quality impact of these industrial wastes because of the variety and complexity of compounds in the effluents. Table VI-3 lists typical pollutants which may result from various petrochemical processes 3/. Many of these waste compounds have toxic, growth inhibiting or carcinogenic effects. Several of these effects have been noted on marine life in Galveston Bay and the Houston Ship Channel and aromatic hydrocarbons, not of natural origin, were recovered from oysters. (See Chapter V). However, no data are available on the specific types of pollutants being discharged by the numerous petrochemical industries.

Other manufacturing processes in the Galveston Bay area produce wastes containing toxic metals which have been observed in the receiving waters. Table VI-4 lists those municipal and industrial sources discharging large quantities of one or more heavy metals.

3/ Gloyna, E. F., and D. L. Ford, The Characteristics and Pollutional Problems Associated with Petrochemical Wastes, Summary Report, Engineering Science Inc./Texas, Austin, Texas, February 1970.

TABLE VI-3

POLLUTANTS ASSOCIATED WITH VARIOUS PETROCHEMICAL PROCESSES

Process	Source	Pollutants
Alkylation: Ethylbenzene		Tar, Hydrochloric Acid, Caustic Soda, Fuel Oil
Ammonia Production	Demineralization	Acid, Bases
	Regeneration, Process Condensates	Ammonia
	Furnace Effluents	Carbon Dioxide, Carbon Monoxide
Aromatics Recovery	Extract Water	Aromatic Hydrocarbons
	Solvent Purification	Solvents - Sulfur Dioxide, Diethylene Glycol
Catalytic Cracking	Catalyst Regeneration	Spent Catalyst, Catalyst Fines (Silica, Alumina Hydrocarbons, Carbon Monoxide, Nitrogen Oxides)
	Reactor Effluents and Condensates	Acids, Phenolic Compounds, Hydrogen Sulfide Soluble Hydrocarbons, Sulfur Oxides, Cyanides
Catalytic Reforming	Condensates	Catalyst (particularly Pt, Mo), Aromatic Hydrocarbons, Hydrogen Sulfide, Ammonia
Crude Processing	Crude Washing	Inorganic Salts, Oils, Water Soluble Hydrocarbons
	Primary Distillation	Hydrocarbons, Tars, Ammonia, Acids, Hydrogen Sulfide
Cyanide Production	Water Slops	Hydrogen Cyanide, Unreacted Soluble Hydrocarbons
Dehydrogenation		
Butadiene Prod. from n-Butane and Butylene	Quench Waters	Residue Gas, Tars, Oils, Soluble Hydrocarbons
Ketone Production	Distillation Slops	Hydrocarbon Polymers, Chlorinated Hydrocarbons, Glycerol, Sodium Chloride
Styrene from Ethylbenzene	Catalyst	Spent Catalyst (Fe, Mg, K, Cu, Cr, Zn)
	Condensates from Spray Tower	Aromatic Hydrocarbons, including Styrene, Ethylbenzene, and Toluene, Tars
Desulfurization		Hydrogen Sulfide, Mercaptans
Extraction and Purification		
Isobutylene	Acid and Caustic Wastes	Sulfuric Acid, C_4 Hydrocarbon, Caustic Soda
Butylene	Solvent and Caustic Wash	Acetone, Oils, C_4 Hydrocarbon, Caustic Soda, Sulfuric Acid
Styrene	Still Bottoms	Heavy Tars
Butadiene Absorption	Solvent	Cuprous Ammonium Acetate, C_4 Hydrocarbons, Oils
Extractive Distillation	Solvent	Furfural, C_4 Hydrocarbons
Halogenation (Principally Chlorination)		
Addition to Olefins	Separator	Spent Caustic
Substitution	HCl Absorber, Scrubber	Chlorine, Hydrogen Chloride, Spent Caustic, Hydrocarbon Isomers and Chlorinated Products, Oils
	Dehydrohalogenation	Dilute Salt Solution
Hypochlorination	Hydrolysis	Calcium Chloride, Soluble Organics, Tars

TABLE VI-3 (Continued)

POLLUTANTS ASSOCIATED WITH VARIOUS PETROCHEMICAL PROCESSES

Process	Source	Pollutants
Hydrochlorination	Surge Tank	Tars, Spent Catalyst, Alkyl Halides
Hydrocarboxylation (OXO Process)	Still Slops	Soluble Hydrocarbons, Aldehydes
Hydrocyanation (for Acrylonitrile, Adipic Acid, etc.)	Process Effluents	Cyanides, Organic and Inorganic
Isomerization in General	Process Wastes	Hydrocarbons; Aliphatic, Aromatic, and Derivative Tars
Nitration		
Paraffins		By-Product Aldehydes, Ketones, Acids, Alcohols, Olefins, Carbon Dioxide
Aromatics		Sulfuric Acid, Nitric Acid, Aromatics
Oxidation		
Ethylene Oxide and Glycol Manufacture	Process Slops	Calcium Chloride, Spent Lime, Hydrocarbon Polymers, Ethylene Oxide, Glycols, Dichloride
Aldehydes, Alcohols, and Acids from Hydrocarbons	Process Slops	Acetone, Formaldehyde, Acetaldehyde, Methanol, Higher Alcohols, Organic Acids
Acids and Anhydrides from Aromatic Oxidation	Condensates	Anhydrides, Aromatics, Acids
	Still Slops	Pitch
Phenol and Acetone from Aromatic Oxidation	Decanter	Formic Acid, Hydrocarbons
Carbon Black Manufacture	Cooling, Quenching	Carbon Black, Particulates, Dissolved Solids
Polymerization, Alkylation	Catalysts	Spent Acid Catalysts (phosphoric Acid), Aluminum Chloride
Polymerization (Polyethylene)	Catalysts	Chromium, Nickel, Cobalt, Molybdenum
Butyl Rubber	Process Wastes	Scrap Butyl, Oil, Light Hydrocarbons
Copolymer Rubber	Process Wastes	Butadiene, Styrene Serum, Softener Sludge
Nylon 66	Process Wastes	Cyclohexane Oxidation Products, Succinic Acid, Adipic Acid, Glutaric Acid, Hexamethylene, Diamine, Adiponitrile, Acetone, Methyl Ethyl Ketone
Sulfation of Olefins		Alcohols, Polymerized Hydrocarbons, Sodium Sulfate, Ethers
Sulfonation of Aromatics	Caustic Wash	Spent Caustic
Thermal Cracking for Olefin Production (including Fractionation and Purification)	Furnace Effluent and Caustic Treating	Acids, Hydrogen Sulfide, Mercaptans, Soluble Hydrocarbons, Polymerization Products, Spent Caustic, Phenolic Compounds, Residue Gases, Tars and Heavy Oils
Utilities	Boiler Blow-down	Phosphates, Lignins, Heat, Total Dissolved Solids, Tannins
	Cooling System Blow-down	Chromates, Phosphates, Algicides, Heat
	Water Treatment	Calcium and Magnesium Chlorides, Sulfates, Carbonates

TABLE VI-4

DISCHARGES OF HEAVY METALS TO THE HOUSTON SHIP CHANNEL[1/]

Industry or Municipality	Outfall Code Number	Flow MGD	Heavy Metals - lb/day				
			Zinc	Lead	Chromium	Cadmium	Copper
Olin Mathieson (Pasadena)	27-1 27-3	8.64 1.44	930 57	43 6	22 -	22 -	303 -
Diamond Shamrock	47-1 47-2 47-5	5.00 90.00 2.88	320 975 72	25 1,420 29	- 150 -	- 1,050 -	- 1,875 -
Armco Steel Corp.* (Sheffield)	28-56	3.50	146	-	-	-	-
Dupont (LaPorte)	60	2.00	168	-	8	-	-
Houston Lighting & Power Co. (Bertron)	58-0	0.51	-	16	-	-	-
Ideal Cement	8-1	1.44	210	13	5	6	-
Goodyear Tire (Houston)	10-2	0.36	-	-	6	-	-
Lubrizol Corp.	45-1	0.75	100	-	-	-	-
Humble Oil (Houston)	61-1	9.00	540	-	30	15	-
Northside Sewage Treatment Plant (Houston)	65-1 65-2	28.00 20.00	1,030 300	- -	47 -	- -	- -
Petro-Tex Chemical	9-2	3.10	196	-	10	-	-
Rohm & Haas (Deer Park)	51-2 (API) 51-1 51-2	0.50 1.00 1.00	21 16 40	- - -	16 9 8	- - -	- - -
Shell Chemical Co. (Deer Park)	44-1	8.20	550	-	-	-	-
Southland Paper (Pasadena)	41	13.60	215	68	-	-	-
Stauffer Chemical (Manchester)	3	0.65	65	2	2	2	102
Upjohn (Carwin)	55	0.61	117	8	5	3	-
Tenneco Chemical (Pasadena)	42-1	2.40	38	-	18	-	20
U.S. Plywood (Pasadena)	21	38.00	1,780	-	-	-	32
Totals	-	242.58	7,886	1,630	336	1,098	2,332

* Twenty-four-hour composite samples collected by the FWQA, South Central Region, showed that this industry was discharging approximately 1,000 lbs. of cyanide and 400 lbs. per day of phenols to the Houston Ship Channel. The Justice Department recently filed suit against this industry under the 1899 Refuse Act.

[1/] Based on effluent data (grab samples only) collected by the Texas Water Quality Board in February 1969. Additional field data are necessary to determine if the samples collected are representative.

Of the 277 municipal and industrial waste sources having discharge permits in the Galveston Bay area, the waste treatment needs and status of 189 are not listed. Where needs are indicated, 40 sources provide inadequate or no treatment and no abatement, beyond engineering studies in a few instances, is in progress. Seventeen sources have treatment facilities in progress; 22 are said to be in compliance with permit requirements. Nine sources either provide adequate treatment or have no needs. These evaluations are based on the inadequate characterization of wastes according to the parameters listed in the Texas permits. An effective waste abatement program is not now being conducted in the Galveston Bay area. A waste source inventory, including characterization of specific compounds discharged, as well as evaluation of present treatment practices and additional needs for each effluent is urgently required. The Texas permits should be revised to reflect the required removal of waste substances causing deleterious effects or hazardous conditions in the receiving waters. A firm compliance schedule for each effluent should be included in the discharge permit.

A summary of municipal and industrial waste discharges by area is listed in Table VI-5.

C. OTHER SOURCES

Many of the small coastal streams entering Galveston Bay flow through heavily industrialized and urban areas. These streams carry surface runoff from such areas following periods of precipitation. Biochemical oxygen demand of urban runoff from the Houston area is

TABLE VI-5

SUMMARY OF PERMITTED WASTE DISCHARGES - GALVESTON BAY AREA

	MUNICIPAL AND DOMESTIC					PETROLEUM, CHEMICAL, PLASTIC, AND RUBBER INDUSTRIES					OTHER INDUSTRIAL				
Area	Number of Sources	Flow MGD	S.S. 1,000 #/day	BOD 1,000 #/day	COD* 1,000 #/day	Number of Sources	Flow MGD	S.S. 1,000 #/day	BOD 1,000 #/day	COD 1,000 #/day	Number of Sources	Flow MGD	S.S. 1,000 #/day	BOD 1,000 #/day	COD 1,000 #/day
Houston Ship Channel and Tributaries excluding Baytown	90	172.2	31.5	31.3	95.2	48	245.2	183.0	76.3	391.1	53	139.6	100.2	73.2	392.8
Baytown Area	7	5.3	1.0	1.0	2.9	5	27.6	15.7	11.2	45.9	-	-	-	-	-
Clear Creek Area (Morgan Point to Eagle Point)	26	15.9	3.0	3.0	8.9	8	10.0	5.3	1.7	15.5	1	-- NEGLIGIBLE --			
Texas City, Galveston, and Dickinson Bayou Areas	6	13.5	2.2	2.2	6.7	11	132.3	234.0	65.9	686.5	6	-- NEGLIGIBLE --			
Trinity Bay and Tributaries	4	2.0	0.4	0.5	1.4	1	4.5	0.8	0.8	2.3	-	-	-	-	-
West Bay and Tributaries	8	6.5	1.3	1.3	3.8	2	3.2	0.8	0.8	2.4	1	1.0	0.6	0.4	1.7
TOTALS	141	215.4	39.4	39.3	118.9	75	422.8	439.6	156.7	1143.7	61	140.6	100.8	73.6	394.5

TOTAL OF ALL SOURCES[1/] Number of Sources = 277; Flow-MGD = 778.8; S.S. (1,000 #/day)= 583.2; BOD (1,000 #/day)= 269.6; COD (1,000 #/day)= 1,657.1

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* COD Values for all but three municipal and domestic sources - all estimated.

1/ Not included in the total waste discharges to the Houston Ship Channel and the Bay is the cooling water discharge (once through flow) of 737.2 MGD permitted to Houston Light and Power Company (S. R. Bertron Plant). Water supply is taken from the Channel.

about 20 mg/l which is comparable to weak municipal wastes. For the 1963-68 period, BOD discharged to the upper 25 miles of the Houston Ship Channel by urban runoff was estimated to average about 92,000 pounds per year. The suspended solids load from urban runoff averaged 550,000 pounds per year from 1963-68[4/].

Rural runoff from areas in the Trinity and San Jacinto River basins may contribute silt and nutrients to the estuary. Construction and operation of Livingston and Wallisville Reservoirs on the Trinity River will substantially reduce the silt load to Galveston Bay.

[4/] Hutton, W. S., R. W. Hann, and R. H. Smith, "A Quantitative and Qualitative Survey of Benthal Deposits Contained in the Houston Ship Channel", Estuarine Systems Projects, Technical Report No. 8, Texas A&M University, May 1970.

VII. ECONOMIC IMPACT OF POLLUTION

Harvesting of shellfish, primarily oysters, has a significant economic value to the Galveston Bay estuary. Bacterial pollution has closed a substantial portion of the estuary to the harvesting of shellfish. Toxic materials and sediments discharged to the estuarial waters have reduced the areas which will support commercially harvestable populations of shellfish[1/]. The depuration of oysters harvested from certain areas is required before the oysters may be marketed, resulting in increased costs to oystermen. The direct economic loss incurred by the shellfish industry as a result of impaired shellfish production produces an associated economic impact on the regional economy.

A. SHELLFISH AREAS CLOSED BY POLLUTION

For at least the last twenty years, a substantial portion of the estuary has been closed to the taking of shellfish for human consumption. Bacteriological criteria and proximity to sources of pollution were the determining factors in defining closed areas. Between 1951 and 1970, the area closed to shellfish harvesting ranged from 205,000 acres to 155,000 acres, or about two-thirds to one-half of the estuarine area. The classifications of various areas of

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[1/] Hutton, W. S., R. W. Hann, and R. H. Smith, "A Quantitative and Qualitative Survey of Benthal Deposits Contained in the Houston Ship Channel", Estuarine Systems Projects, Technical Report No. 8, Texas A&M University, May 1970.

the estuary relative to shellfish harvesting as established for the 1970-71 shellfish season are shown in Figure VII-1.

Between 1955 and the present, three significant changes were made in the sizes and locations of the closed and open areas. The total area open in 1955 approximated the open area for 1966 although boundaries differed slightly. Between 1955 and 1958, the open area remained about the same. In 1958, open areas in upper Galveston Bay were reduced in size and a conditionally approved area was established. The conditionally approved area, which had essentially the same boundaries as shown in Figure VII-1, was subject to temporary closure following periods of high surface runoff. The open areas retained the same boundaries until 1966 when an additional area in lower Trinity Bay was opened to shellfish harvesting. The Trinity Bay area was again enlarged in 1969, establishing the open area boundaries shown in Figure VII-1.

The major changes in open and closed areas over the past 15 years have been in upper Galveston Bay and Lower Trinity Bay. Only limited areas of commercially important oyster producing reefs were changed in classification. The actual oyster producing area approved for harvesting has remained relatively the same for the past ten years. Although the water area open for shellfish taking has been substantially increased over the past twenty years, the actual area of producing reefs has not been proportionately increased and has probably decreased as a result of destruction of reefs by siltation and shell dredging.

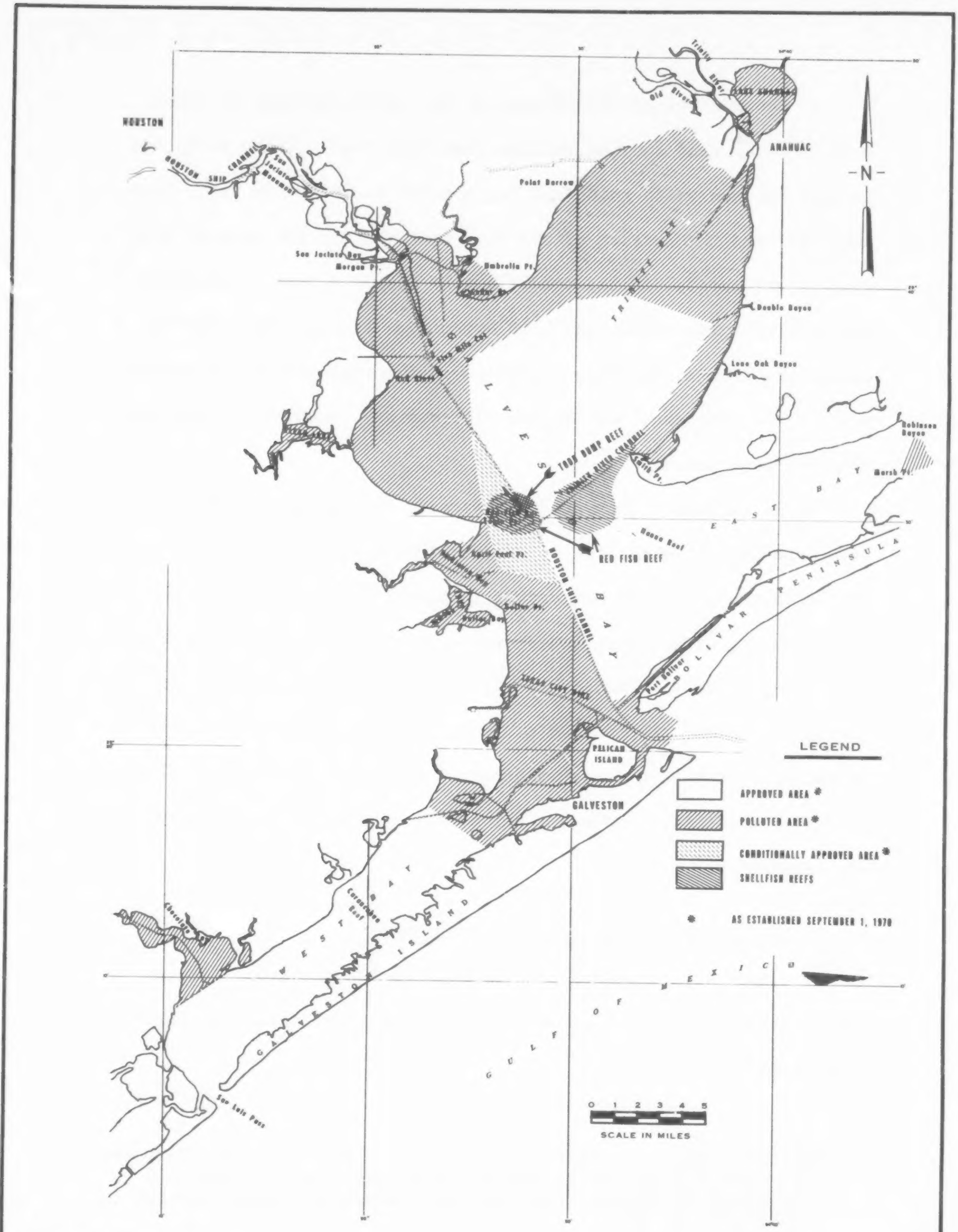
HOUSTON
HOUSTON SHIP CHANNEL
San Jacinto Monument
Trinity River
Old River
ANAHUAC
N
Point Barrow
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
TRINITY BAY
Double Bayou
Five Mile Cut
Lone Oak Bayou
GALVESTON BAY
Robinson Bayou
TODD DUMP REEF
TRINITY RIVER CHANNEL
Smith Pt.
Marsh Pt.
EAST BAY
Hanna Reef
RED FISH REEF
Eagle Point
HOUSTON SHIP CHANNEL
Dollar Pt.
BOLIVAR PENINSULA
TEXAS CITY DIKE
Port Bolivar
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES
LEGEND
APPROVED AREA *
POLLUTED AREA *
CONDITIONALLY APPROVED AREA *
SHELLFISH REEFS
* AS ESTABLISHED SEPTEMBER 1, 1970

Figure VII - 1 Classifications of Shellfish Harvesting Areas

At present, almost 90 percent of the oyster harvest is taken from Red Fish Reef and the smaller Todd Dump Reef. These reefs are located between Smith Point and Eagle Point in Galveston Bay. Todd Dump Reef and the portion of Red Fish Reef west of the Houston Ship Channel are located in the conditionally approved area. Temporary closures of this area during high streamflow periods can restrict harvesting from a significant portion of the most productive oyster reefs. The frequency and lengths of temporary closures of this area have not been documented.

It is estimated that productive reefs in open shellfishing areas now have a total area of about 9,100 acres. Estimates of shellfish areas open to harvesting in the past were utilized to determine the approximate annual yield of oyster meat from one acre of productive reef. Except for 1965, this yield has remained relatively stable for the 1963-69 period. The average yield for this period was considered representative of the level of production per acre that could be sustained under normal conditions in the Galveston Bay estuary.

B. PRODUCTIVE SHELLFISH BEDS IN CLOSED AREAS

The following statement by Congressman Bob Eckhardt of Texas was presented at a public hearing for the National Estuarine Pollution Study[2/].

[2/] Eckhardt, Bob, U.S. Representative, 8th District Texas, Statement presented by Mr. Keith Ozmore, staff assistant, to National Estuarine Pollution Study Hearing, Galveston, Texas, October 8, 1968.

> "I am informed by the Texas Parks and Wildlife Department that the 42 percent of the estuary which is off-limits for oyster production contains some 1,500 acres of producing oyster reefs, or roughly 15.7 percent of the oyster reefs in the entire estuary. This means that each year we are losing 692,429 pounds of oyster meats, worth some $311,593 because they cannot be marketed. And this does not reflect the total loss. By the time you figure that landed value, this means that we are losing $3,115,930 in the oyster fishery because of pollution."

Another estimate prepared by the Texas Parks and Wildlife Department in 1970 indicated that there are currently 1,000 acres of oyster beds located in polluted areas of which about 500 acres would support commercial harvesting[3/]. Closed productive areas are primarily located in Dickinson Bay and West Bay.

A number of smaller reefs closed to harvesting are located in areas with suitable salinity for oyster production. Some of these reefs support populations of small oysters which do not reach marketable size. It is believed that these reefs could support marketable oysters if suitable water quality enhancement were achieved.

A number of shellfish beds located in closed areas are accessible by foot during low tide, or by small boat. Local health authorities have encountered problems in preventing sport shellfishing in these areas. Consumption of shellfish from these areas poses a health hazard, as the shellfish may be contaminated by bacteria and toxic materials.

[3/] Singleton, J. R., Texas Parks and Wildlife Department, Letter regarding oyster harvesting areas in Galveston Bay within polluted waters; also recent dockside value of oyster harvests in Galveston Bay, November 1970.

C. ECONOMIC DAMAGES

The average yield of producing shellfish beds in open areas provides a reasonable estimate for the average harvest which could be obtained from beds located in closed areas if shellfishing restrictions caused by pollution were removed. The average yield for the 1963-69 period was 392 pounds of oyster meat per acre.

Estimates of producing oyster reefs in the areas closed due to pollution range from 1,500 acres[2/] to 500 acres[3/]. If 1,500 acres could be made commercially available due to abatement of pollution, an additional 588,000 pounds of oyster meat would be harvested. At 1969 prices of $0.44 per pound, this harvest has a dockside value of $258,000. If only 500 acres are commercially available, the dockside value of 196,000 pounds would be $86,000. A recent survey of the Florida shellfish industry states that the final retail value of shellfish products is roughly four times the dockside value[4/]. The economic damage to shellfish harvesters caused by closure of producing shellfish areas due to pollution ranges between $344,000 and $1,030,000 annually.

Approximately 16,000 barrels of oysters were harvested using depuration techniques in the 1968-69 season. The extra handling

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[2/] Eckhardt, Bob, U.S. Representative, 8th District Texas, Statement presented by Mr. Keith Ozmore, staff assistant, to National Estuarine Pollution Study Hearing, Galveston, Texas, October 8, 1968.

[3/] Singleton, J. R., Texas Parks and Wildlife Department, Letter regarding oyster harvesting areas in Galveston Bay within polluted waters; also recent dockside value of oyster harvests in Galveston Bay, November 1970.

[4/] Colbert, J. R., and D. M. Windham, The Oyster Based Economy of Franklin County, Florida, U.S. Public Health Service, DHEW.

in transplanting oysters from polluted areas to approved areas in the depuration process increases the costs of marketing oysters and results in an additional economic impact. It is estimated that the costs associated with depuration in Galveston Bay total $15,000 annually. The total actual damages caused by the inability to market shellfish due to pollution in Galveston Bay are between $359,000 and $1,045,000 annually.

If examination of water quality for approval of areas for shellfish harvesting were regularly conducted under the most unfavorable hydrographic and pollution conditions as required by applicable standards, it is probable that the most productive reefs in Galveston Bay now approved for harvesting, would have to be closed due to excessive bacteriological pollution. These conditions occurred about 40 percent of the time during the 1969 season. Furthermore, concentrations of hydrocarbon residues, exceeding those which resulted in closure of shellfishing areas in West Falmouth Harbor, Massachusetts, have been recovered from Galveston Bay oysters taken from approved areas. Heavy metals concentrations in Galveston Bay waters greatly exceed natural background concentrations. Galveston Bay should be closed to all shellfish harvesting immediately until the health hazard associated with waste discharges is clearly ascertained and eliminated. Consideration should also be given to prohibiting all commercial fishing in Galveston Bay until it has been ascertained that the marine species taken from the Bay are suitable for human consumption. The value of the commercial fishery in Galveston Bay during 1964* was $2,797,400[5/]. Prohibition of commercial fishing represents a substantial economic damage. Assuming a 5 percent rate of return on this renewable resource, commercial fishing represents to the Galveston Bay area a $56,000,000 capital investment, based on 1964 figures, which has been endangered due to pollution from municipal and industrial wastes. I might add that in 1969 in the commercial fishery, it was $13.1 million using the same simple rate of interest of 5 percent and this would amount to $262 million capital investment.

* Mr. Gallagher corrected that by saying: "That is also incorrect. The correct reference is the impact on the Texas Bay Systems in 1966."

5/ Eckhardt, Bob, U.S. Representative, 8th District Texas, Statement presented by Mr. Keith Ozmore, staff assistant, to National Estuarine Pollution Study Hearing, Galveston, Texas, October 8, 1968.

VIII. WATER QUALITY IMPACT OF FUTURE DEVELOPMENTS

A. HOUSTON WATER SUPPLY DIVERSION

Development of the Trinity River as an additional water supply for the Houston metropolitan area is nearing the final stages. Wallisville and Livingston Reservoirs on the Trinity River and a pipeline from Wallisville Reservoir to the Houston area are the major features of the Trinity River supply system.

Livingston Reservoir was recently constructed by the Trinity River Authority to provide storage for regulation of flow in the lower river and for increasing the firm yield of the watershed for water supply purposes.

Construction of Wallisville Reservoir was recently initiated by the Corps of Engineers. This reservoir, located about four miles upstream from the mouth of the river and downstream from Livingston Reservoir, will provide a barrier against upstream intrusion of saline water from Trinity Bay during high tide and low flow conditions and will serve as an intake point for the water supply pipeline to Houston. Since the reservoir will have only a small amount of active storage, little regulation of stream flow will be produced other than that achieved by diversions to Houston. Construction of Wallisville Reservoir will inundate part of the productive shrimp nursery areas in Trinity Bay.

Wallisville Reservoir alone will produce only a small effect on water quality in the estuary. The complete Trinity River water supply system will, however, substantially alter circulation and water quality conditions. The most significant effect of the water supply system will be to reduce the freshwater inflow to Trinity Bay. It is estimated that the average freshwater discharge from the Trinity River into Trinity Bay will be decreased by about 13 percent by 1980. This reduction would result from the combination of an average diversion of about 540 cubic feet per second (cfs) through the pipeline to Houston and the depletion of streamflow in the upper watershed due to the expanded needs of the Dallas-Fort Worth area and increased usage for irrigation.

At any point in Trinity Bay, salinity concentrations are primarily a function of the Trinity River discharge. During the spring high flow season, salinity levels throughout the Bay are at their lowest and increase with distance from the mouth of the Trinity River. Salinity levels are the highest during the late summer low flow period. A reduction in average freshwater inflow would thus be expected to produce an increase in average salinity levels. The Corps of Engineers has conducted an evaluation of salinity concentrations and circulation patterns in the entire Galveston Bay estuary system using a physical hydraulic model1/. Existing (1965) and future (1980) conditions of water use were simulated. The results of the model tests indicated that 1980

1/ Bobb, W. H., and R. A. Boland, Jr., Galveston Bay Hurricane Surge Study, Technical Report H-69-12, July 1970, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

average salinity levels would increase slightly (0-10 percent) over 1965 levels at most locations in Trinity Bay with increases as high as 50 percent produced at a few locations for part of the year.

The suitability of an estuarine area for a shrimp nursery is highly dependent upon salinity conditions. Abnormal salinity fluctuations can be expected to affect development of juvenile shrimp. Increases in average salinity concentrations will alter the area having salinity levels suitable for a nursery. The average annual value of shrimp harvested from the estuary is nearly $1 million. This harvest represents only a fraction of the adult shrimp produced by the Trinity Bay nursery, as many shrimp caught in other areas were hatched in Trinity Bay. Any reduction in the shrimp production of this nursery would thus have a substantial economic impact.

Water use for municipal and industrial purposes in the Houston metropolitan area is projected to substantially increase in the future. Most of this increased water use will be returned to the estuary, primarily the Houston Ship Channel, as municipal and industrial waste discharges. Additional waste discharges to the Ship Channel will require that higher levels of treatment be provided for all waste sources to maintain acceptable water quality.

Perhaps the most significant result of increased waste discharges would be the augmentation of freshwater inflow to the Ship Channel. It is estimated that this flow augmentation will be almost 200 percent of present low flows under 1980 conditions of water use.

The net effect of the circulation pattern in the Houston Ship Channel is to transport pollutants from the Channel into the Bay via the surface freshwater outflow. Flow augmentation will result in more rapid transport of pollutants to the Bay; the frequency of flushing of the Channel would also increase. If water quality in the Ship Channel is not improved, flow augmentation could result in greater degradation of water quality in the Bay.

B. CEDAR BAYOU POWER PLANT

A large-scale fossil fueled electric generating plant known as the Cedar Bayou Power Plant is being constructed by the Houston Lighting and Power Company at a location on Cedar Bayou near the north shore of Trinity Bay. The plant is scheduled to be built in six stages. Each of the first four stages will consist of one 750-megawatt power unit. The last two stages will add one 1,000-megawatt unit each, bringing the ultimate generating capacity of the plant to 5,000 megawatts. The first unit is scheduled to be on line by mid-1971, with the second unit available about a year later. Completion of all six stages will be in the mid-1980's.

A once-through cooling water system will be utilized by the plant. Water will be drawn into the plant through an intake channel dredged down Cedar Bayou through Tabbs Bay to upper Galveston Bay as shown in Figure VIII-1. As the intake channel through Tabbs Bay is only two to three times the depth of the Bay, some of the cooling

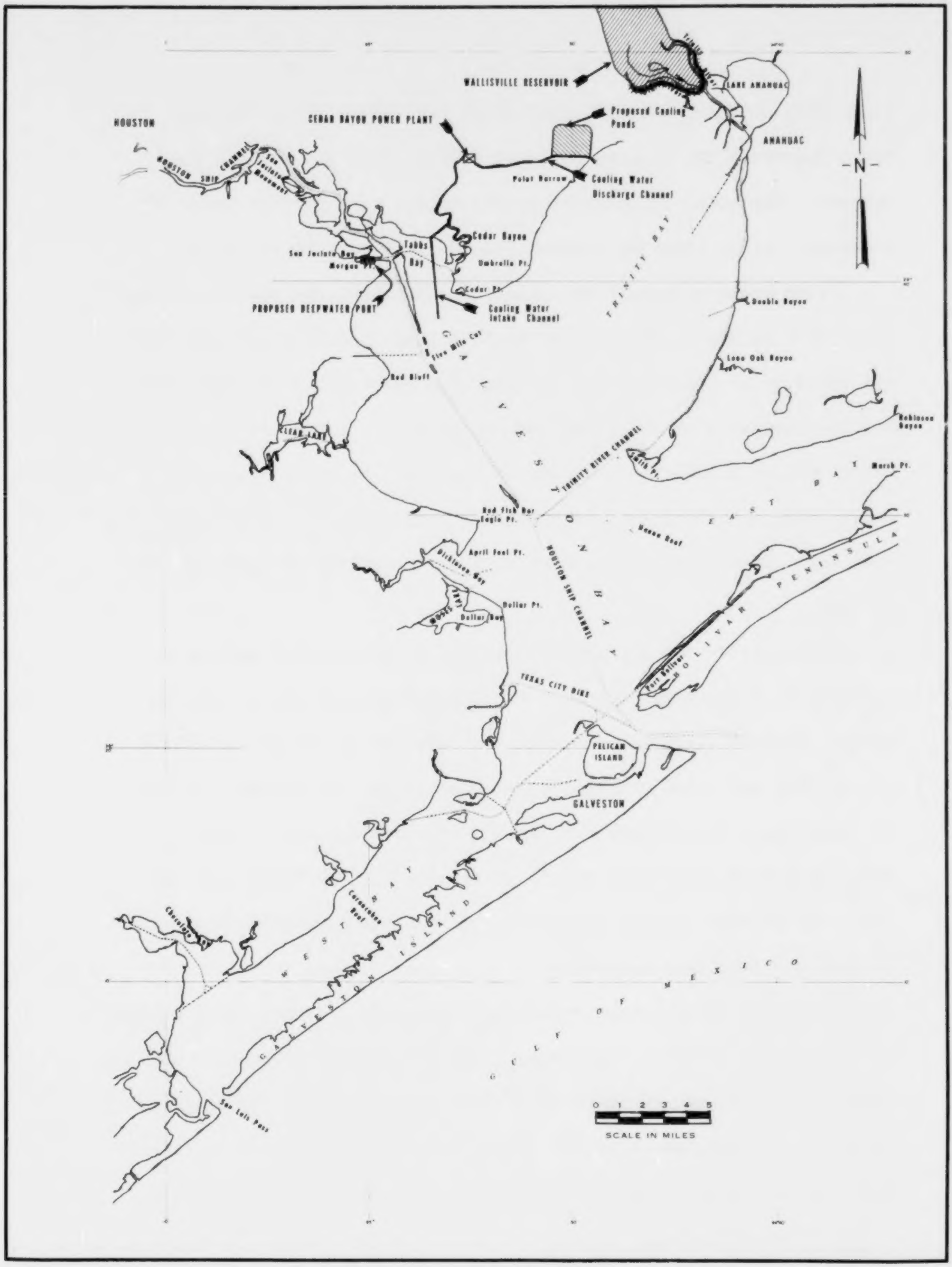
WALLISVILLE RESERVOIR
Trinity River
LAKE ANAHUAC
HOUSTON
CEDAR BAYOU POWER PLANT
Proposed Cooling Ponds
ANAHUAC
N
HOUSTON SHIP CHANNEL
San Jacinto Monument
Point Barrow
Cooling Water Discharge Channel
Cedar Bayou
Tabbs Bay
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
TRINITY BAY
PROPOSED DEEPWATER PORT
Cooling Water Intake Channel
Double Bayou
Five Mile Cut
Red Bluff
Lone Oak Bayou
GALVESTON BAY
CLEAR LAKE
TRINITY RIVER CHANNEL
Smith Pt.
Robinson Bayou
Marsh Pt.
EAST BAY
Red Fish Bar
Eagle Pt.
Moses Reef
April Fool Pt.
Dickinson Bay
HOUSTON SHIP CHANNEL
Dollar Pt.
MOSES LAKE
Dollar Bay
BOLIVAR PENINSULA
Port Bolivar
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
GULF OF MEXICO
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

Figure VIII - 1 Future Development

water will be drawn directly from Tabbs Bay. Both Tabbs Bay and upper Galveston Bay receive polluted outflow from the Houston Ship Channel. The point of entrance of the intake channel into Tabbs Bay is about 2 miles from the Houston Ship Channel near Morgan Point.

After passing through the plant's condensers, the heated cooling water will be discharged into a six mile long channel which will convey the flow to upper Trinity Bay near the mouth of the Trinity River. For the operation of the first two stages of the plant, the cooling water will be discharged directly to the Bay. As later stages are constructed a 2,600-acre baffled cooling pond will be added to the discharge channel to provide evaporative cooling before discharge to the Bay.

Operation of the first two power units with a total generating capacity of 1,500 megawatts will require about 1,500 cfs of cooling water. Cooling water requirements are expected to increase to 3,500 cfs in 1980 and 5,000 cfs upon completion of all six stages. By way of comparison, the average discharge of the Trinity River, the major source of freshwater inflow to Trinity Bay, is 7,900 cfs. In 1965, the minimum average weekly flow into the entire Galveston Bay estuary was less than 1,000 cfs.

Operation of the Cedar Bayou Power Plant will impact water quality of the estuary in three major ways. (1) The temperature of the cooling water will be raised by about 20°F as it passes through the plant's condensers, resulting in the discharge of a large heat load to Trinity Bay. (2) The quality of the water drawn into the system from Tabbs

Bay will be poorer than the present quality of upper Trinity Bay. The cooling water discharge will thus transport pollutants to Trinity Bay. (3) The discharge of large volumes of saline water from Tabbs Bay to the less saline waters of Trinity Bay will increase average salinity concentrations in Trinity Bay.

The Texas Water Quality Board has granted a permit covering the discharge of 1,500 cfs of cooling water from the first two units and has recently granted permits to cover the ultimate 5,000 cfs discharge, over the objections of the Environmental Protection Agency. The present permit allows a maximum temperature of 115°F and a daily average temperature of 110°F at the point of discharge of cooling water to the six mile canal. Some cooling will be achieved in the canal but the discharge to Trinity Bay will still be substantially warmer than existing maximum temperatures, which are in the low 90's.

Under full-scale operation, the cooling ponds will be utilized to remove about one-half of the heat load contained in the cooling water and reduce discharge temperatures. The residual heat load discharged to the Bay will still be sufficient to significantly increase the surface temperature of several square miles of the Bay. The National Technical Advisory Committee on Water Quality Criteria has recommended that the monthly mean of the maximum daily water temperatures should not be increased by more than 1.5°F by the artificial addition of heat during June, July and August, nor more than 4°F during the remainder of the year[2/]. The Texas Water Quality Requirements specify that a 1.5°F rise in the representative temperature above natural conditions is not to be exceeded during the summer, nor more than 4°F during fall, winter and spring. The area of the zone which will exceed the 1.5°F limit when the plant is in full operation is controversial but is estimated to be in the range of 600 to 2,200 acres. Measurable temperature increases will extend over a much larger area.

The impact of the expected water temperature increases on the shrimp nursery of Trinity Bay and other aquatic life is also a controversial subject. Increasing water temperatures have been found to be beneficial to some stages of shrimp development and detrimental to other stages.

Withdrawal of large quantities of cooling water is also expected to increase the dispersion of Houston Ship Channel pollution into Tabbs Bay, with attendant water quality degradation. The cooling system will thus provide a route for direct transmission of channel pollution to the relatively good quality water of upper Trinity Bay.

The Corps of Engineers model study evaluated the combined effects of the Cedar Bayou Power Plant, upstream development on the Trinity River, Wallisville Reservoir, and increased flow in the Houston Ship Channel on the dispersion of pollutants from the Ship Channel through-

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[2/] Federal Water Pollution Control Administration, Water Quality Criteria, Report of National Technical Advisory Committee, April 1968, pp. 68-70.

out the estuary[3/]. The model study compared dispersion patterns under existing (1965) conditions with predicted dispersion patterns for proposed 1980 conditions of water use. A cooling water discharge of 3,500 cfs was used for the Cedar Bayou Power Plant. The relative concentrations of persistent pollutants would increase by as much as 600 percent in portions of upper Trinity Bay during low flow conditions. Flow-through time in the cooling water system is less than four days, indicating that the concentrations of degradable pollutants would also increase substantially. It would appear that increasing the power plant discharge to 5,000 cfs would further increase the concentration of pollutants.

Salinity concentrations in Tabbs Bay and upper Galveston Bay are higher than in upper Trinity Bay. The cooling water system will thus contribute to some increase in salinity levels in Trinity Bay. Evaporation from the cooling ponds will also slightly increase the salinity of the cooling water discharge. The combined effects of the cooling water discharge and reduced freshwater inflow from the Trinity River on salinity levels were evaluated by the model study. Predicted future increases in average salinity levels for both low-flow and high-flow periods are larger in the Trinity Bay area than any other area of the estuary. Since Trinity Bay is a prime shrimp nursery area and shrimp propagation is affected by salinity levels, the most significant changes in future salinity levels will come in an area where they can cause the most damage.

[3/] Bobb, W. H., and R. A. Boland, Jr., Galveston Bay Hurricane Surge Study, Technical Report H-69-12, July 1970, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

C. MORGAN POINT DEEPWATER PORT

With the exception of port facilities in Galveston and Texas City, almost all of the existing deepwater port facilities in the estuary are located on the landlocked portion of the Houston Ship Channel above Morgan Point. In this location, any vessel pollution, oil spills and waste discharges associated with operations of port facilities and ancillary industries may be somewhat diluted and dispersed by the time they reach the higher quality open waters of Galveston Bay.

The Port of Houston has announced plans to construct a new major deepwater port facility at the site of the existing shallow draft Barbour Terminal near Morgan Point. This location is immediately adjacent to the open waters of upper Galveston Bay. Any pollution from this facility could thus be carried directly to the Bay by wind currents and prevailing circulation patterns. The proximity of the port facility to the Cedar Bayou Channel and the cooling water intake of the Cedar Bayou Power Plant would provide an avenue for rapid transport of additional pollution to Trinity Bay.

The magnitude of the pollution hazard posed by the port facility will be primarily dependent upon the types of activities occurring at the port. As presently planned, the major port activity will be the handling of containerized cargo from large container ships and the loading and unloading of barges from barge carrying ships. This type of activity should generate minimal pollution except for vessel pollution caused by the incrased vessel activity in the area. Should the port also be used for the off-loading of cargo from deep-draft to shallow-draft vessels for transshipment on the area's shallow-draft channels, the potential for spills of oil and hazardous materials would be increased.

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APPENDIX A

Applicable Texas Water Quality Requirements For The Galveston Bay Area[1] And The Public Health Service Manual "Sanitation of Shellfish Growing Areas"

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[1] See Figure V-1 for Water Quality Zones established in the Galveston Bay Area.

GENERAL STATEMENT TEXAS WATER QUALITY REQUIREMENTS

The Texas Water Quality Act, through which the State of Texas expresses its interest in the quality of the waters in the state, sets forth the following statement of policy: "It is declared to be the policy of the State of Texas to maintain purity of the waters of the state consistent with the public health and public enjoyment thereof, the propagation and protection of fish and wildlife, including birds, mammals, and other terrestrial and aquatic life, the operation of existing industries, and the economic development of the state, and to that end to require the use of all reasonable methods to implement this policy."

The water quality requirements set forth herein have been developed under authority of State law in line with the foregoing statement of legislative policy and are considered to be in the best interests of the State of Texas. These water quality requirements, insofar as applicable to the interstate waters in Texas, are submitted to the United States Department of the Interior for approval as the water quality standards for such waters, in accordance with Section 10(c) of the Federal Water Pollution Control Act (33 U.S.C. 466g(c). The water quality requirements applicable to the intrastate waters in Texas are provided to the Federal Water Pollution Control Administration only for purposes related to the qualification of projects under the Federal construction grant program as authorized in Section 8 of the Act (33 U.S.C. 466(e).

In implementing the legislative policy expressed in the Texas Water Quality Act of 1967 and subject to the foregoing, it is the policy of the Texas Water Quality Board that the interstate waters in the State whose existing quality is better than the applicable water quality requirements described herein as of the date when these requirements become effective will as provided hereafter be maintained at their high quality, and no waste discharges may be made which will result in the lowering of the quality of these waters unless and until it has been demonstrated to the Texas Water Quality Board that the change is justifiable as a result of desirable economic or social development. Therefore, the Board will not authorize or approve any waste discharge which will result in the quality of any of the interstate waters in the State being reduced below the water quality standards without complying with the Federal and State laws applicable to the amendment of water quality standards. Anyone making a waste discharge from any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to any of the interstate waters in the State will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology consistent with the best practice in the particular field affected under the conditions applicable to the project or development. In the spirit of the Federal Water Pollution Control Act, the Board will keep the Department of the Interior informed on its activities and will furnish to the Department such reports, in such form, and containing such information as the Secretary of the Interior may from time to time reasonably require to carry out his functions under the Act. Additionally, the Board will consult and cooperate with the Department of the Interior on all matters affecting the Federal interest.

The Texas Water Plan presently being developed by the Texas Water Development Board is a flexible proposal for the administration of water resources to meet water needs for all purposes throughout the state to the year 2020 and beyond. The Plan, when complete, will propose a method of implementation in accordance with the statutory directive that the Plan be developed with "regard for the public interest for the entire state . . . in order that sufficient water will be available at reasonable cost to further the economic development of the entire state." The Texas Water Quality Requirements, or the Texas Water Quality Plan, is a companion plan to the Texas Water Plan.

The Wagstaff Act, passed in 1931, establishes the priority of uses as between applicants for permits to appropriate water from the same source of supply. The preferences of use in order of sequence are: (1) domestic and municipal, (2) industrial, (3) irrigation, (4) Mining and recovery of minerals, (5) hydroelectric power, (6) navigation, and (7) recreation. Cities are empowered to acquire the use of surface waters for domestic and municipal purposes from an appropriator who uses the water for a lower purpose, provided the appropriation from a lower use was perfected after the 1931 Wagstaff Act. Texas also has a dual riparian and appropriative rights system, which prevents the precise administration of the surface waters in the state as to particular uses, although the Texas Water Rights Adjudication Act, recently adopted by the Legislature, should alleviate this. The Texas Water Plan also envisions the transfer of waters across the face of the state to meet water needs, and this will affect the water quality requirements for those waters. The examples of water uses set forth on the water quality requirement pages following are indicators of the uses to which the water might reasonably be put. Water uses of a non-consumptive nature such as fishing, recreation, aesthetics, and navigation under some conditions may be recognized and provided for independently of statutory consumptive uses.

1. The surface waters of the State of Texas, for the purposes of this document, are divided into two categories, namely:

   A. Inland Waters - Those surface waters not subject to the ebb and flow of the tides.
   B. Tidal Waters - Those waters of the Gulf of Mexico within the jurisdiction of the State of Texas, bays and estuaries thereto, and those portions of the river systems which are subject to the ebb and flow of the tides, and to the intrusion of marine waters.

2. For inland waters, the proposed requirements are based on an evaluation of available data and reflect those quality conditions which can be attained in streams when there is a discernible flow in the stream. These requirements also apply to reservoirs, lakes and impoundments, bays and estuaries and other coastal waters of the state, except as provided in paragraph 7.

3. Sampling will be in accordance with fully recognized procedures. Samples must be representative of the receiving waters allowing time and distance for mixing.

4. The water quality requirements represent arithmetic average conditions over a period of one year, but maxima and minima for some parameters are shown where average values do not provide the necessary degree of understanding or regulatory base. The water quality requirements apply at approximately the mid-point of the zone with reasonable gradients applying toward zonal boundaries; where three consecutive samples taken in the regular course of surveillance activities reflect a water quality less than that shown in the water quality requirement, an investigation will be made to determine the cause of the lower quality water and the appropriate action to be taken.

5. The values established by the parameters in these water quality requirements relate to analytical procedures outlined in the latest edition of the "Standard Methods for the Examination of Water and Wastewater" as prepared and published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation.

   In evaluating toxicity, bioassay techniques are to be selected suited for the particular purpose at hand.

   Where water quality requirements need supplementing to provide adequate water quality protection, such terms and conditions as may be necessary will be placed in permits for discharges of wastes.

   Taste and odor producing substances shall be limited to concentrations in the waters of the state that will not interfere with the production of potable water by reasonable water treatment methods, or impart unpalatable flavors to food fish, including shellfish, or result in offensive odors arising from the waters, or otherwise interfere with the reasonable use of the waters.

6. The suitability of water for irrigation will be based on the irrigation water classification system developed by the University of California at Davis and the U. S. Salinity Laboratory at Riverside, California. Class I irrigation water is desirable, and will be assumed wherever possible. Class II or Class III irrigation water may be satisfactory under conditions of soil, climate, irrigation practices, and crops where impairment and deterioration will not ensue.

   The SAR (sodium adsorption ratio) should not exceed 8 for waters safe for irrigation. Sampling and analytical procedures and schedules are not specified but will be as appropriate for adequate protection of irrigation waters.

   A resolution of the Texas State Department of Health applies as to the sanitary quality of irrigation waters.

7. Although temperature requirements are included in these water quality requirements, information on stream and bay temperatures and information on the effects of stream and bay temperatures on the state fisheries resource is inadequate on a statewide basis. Water uses requiring temperature control have not been inventoried and their intake water temperature needs are not known. The state has initiated a survey program to obtain adequate background data on water and waste temperatures. In addition, at Texas A & M University, under sponsorship of the Electric Utilities of Texas Committee on Water Quality, a research program has been initiated seeking to provide, from the fisheries standpoint, an acceptable basis for setting water temperature requirements. It is the intention of the Texas Water Quality Board when sufficient firm information is available, to review in full the water temperature requirements set herein as may be deemed appropriate. During this interim period, the temperature conditions shown in these water quality requirements will apply. No temperature

requirements apply to off-stream or privately owned reservoirs. The temperature requirements are intended to be read broadly and with judgment. Generally speaking, temperature requirements refer to the representative temperature throughout the entire body of water into which the waste discharge is made. The extent of the receiving body of water can only be defined on the basis of judgment and knowledge of existing conditions.

8. Water oriented recreation, including water contact sports, is a desirable use of the waters of the state everywhere. Water contact activities in natural waters are not opposed by the state health agency where routine sanitary surveys support such activities, and where, in addition, as a flexible guideline to be used in the light of conditions disclosed by the sanitary survey, the geometric means of the number of fecal coliform bacteria is less than 200 per hundred milliliters and not more than 10% of the samples during any thirty (30) day period exceed 400 fecal coliform bacteria per hundred milliliters. This policy is advisory only and in no way limits the responsibilities and authorities of local health agencies.

9. It is highly desirable for waters comprising the raw water supply to a public surface water treating plant that the total coliform bacteria should not exceed 100 per 100 milliliters and the fecal coliform bacteria should not exceed 20 per 100 milliliters. Nevertheless, raw water supplies to surface water treating plants shall not be deemed unsatisfactory where the total coliform orgainisms do not exceed 20,000 per 100 milliliters and the fecal coliform organisms do not exceed 2,000 per 100 milliliters. The evaluation of raw water supplies cannot be reduced to the simple counting of bacteria of any kind and the foregoing must be used with judgment and discretion and this paragraph is not intended to limit the responsibilities and authorities of responsible local governments or local health agencies.

10. Nothing in these water quality requirements limits the authority of the Commissioner of Health of the State of Texas to take such public health protective measures as he may deem necessary.

11. It is the policy of the State of Texas, acting through the Texas Water Quality Board, to require primary and secondary

treatment and disinfection (except for oxidation pond effluents) at all facilities serving the general public and which treat domestic sanitary wastes. Treatment or control of industrial wastes is equally as important as the treatment or control of municipal (domestic) wastes. It is the policy of the Texas Water Quality Board to require a comparably high standard of treatment or control of industrial wastes being discharged to the waters of the State. Therefore, anyone making a waste discharge from any industrial, public or private project or development which would constitute a new source of pollution to any of the waters in the State will be required, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology consistent with the best practice in the particular field affected under the conditions applicable to the project or development.

12. The general water quality requirements listed below are applicable to all waters at all times:

    A. Essentially free of floating debris and settleable suspended solids conducive to the production of putrescible sludge deposits or sediment layers which would adversely affect benthic biota, or other lawful uses.

    B. Essentially free of settleable suspended solids conducive to changes in the flow character of stream bottoms, to the untimely filling of reservoirs and lakes, and which might result in unnecessary dredging costs.

    C. The surface waters in the state shall be maintained in an aesthetically attractive condition.

    D. There shall be no substantial visible contrast to the natural appearance of the receiving waters so far as is feasible after wastes receive the best practicable treatment or control.

    E. There shall be no substantial increase in turbidity due to waste discharges.

GULF OF MEXICO AT GALVESTON

0901

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	20,000 mg/l
B.	Sulphate average not to exceed	3,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	45,000 mg/l
D.	B.O.D., average not to exceed	1.0 mg/l
E.	Dissolved Oxygen, not less than	7.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	5.0/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Does not apply to Gulf Waters.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

GULF OF MEXICO AT GALVESTON

0901

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation

TRINITY RIVER TIDAL

0902

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	6,000 mg/l
B.	Sulphate, average not to exceed	500 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	10,000 mg/l
D.	B.O.D., average not to exceed	4.0 mg/l
E.	Dissolved Oxygen, not less than	6.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	1,000 /100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the *Texas Regulations for Control of Radiation* issued thereunder.

TRINITY RIVER TIDAL

0902

Water Quality is deemed suitable for the following uses among others:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation
- Industrial Cooling Water

Known water uses:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation

SAN JACINTO RIVER TIDAL
(ALSO SEE TWQB ORDER 65-9)

0903

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	10,000 mg/l
B.	Sulphate, average not to exceed	1,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	20,000 mg/l
D.	B.O.D., average not to exceed	2.0 mg/l
E.	Dissolved Oxygen, not less than	4.0 mg/l
F.	pH Range	6.2-8.5
G.	MPN, logarithmic average not more than	50/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

SAN JACINTO RIVER TIDAL

(ALSO SEE TWQB ORDER 65-9)

0903

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

HOUSTON SHIP CHANNEL
(TURNING BASIN AREA)

0904

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	4,000 mg/l
B.	Sulphate, average not to exceed	600 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	9,500 mg/l
D.	B.O.D., average not to exceed	7.0 mg/l
E.	Dissolved Oxygen, not less than	1.5 mg/l
F.	pH Range	6.0-8.5
G.	MPN, logarithmic average not more than	100,000 /100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Does not apply.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

HOUSTON SHIP CHANNEL
(TURNING BASIN AREA)

0904

Water Quality is deemed suitable for the following uses among others:

- Aesthetics
- Navigation
- Industrial Cooling Water

Known water uses:

- Navigation
- Industrial Cooling Water

HOUSTON SHIP CHANNEL–SAN JACINTO MONUMENT TO TURNING BASIN

(MEASURED AT SAN JACINTO MONUMENT TO CONFORM WITH TWQB ORDER 65-9)

0905

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	7,000 mg/l
B.	Sulphate, average not to exceed	1,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	16,000 mg/l
D.	B.O.D., average not to exceed	5.0 mg/l
E.	Dissolved Oxygen, not less than	2.0 mg/l
F.	pH Range	6.0-8.5
G.	MPN, logarithmic average not more than	10,000 /100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F rise in the representative temperature above natural conditons.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

HOUSTON SHIP CHANNEL–SAN JACINTO MONUMENT TO TURNING BASIN

(MEASURED AT SAN JACINTO MONUMENT TO CONFORM WITH TWQB ORDER 65-9)

0905

Water Quality is deemed suitable for the following uses among others:

Non-Contact Recreation
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Non-Contact Recreation
Aesthetics
Navigation
Industrial Cooling Water

HOUSTON SHIP CHANNEL–MORGANS POINT TO SAN JACINTO MONUMENT

(MEASURED AT MORGANS POINT IN CONFORMANCE WITH TWQB ORDER 65-9)

0906

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	10,000	mg/l
B.	Sulphate, average not to exceed	1,000	mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	20,000	mg/l
D.	B.O.D., average not to exceed	2.0	mg/l
E.	Dissolved Oxygen, not less than	4.0	mg/l
F.	pH Range	6.2-8.5	
G.	MPN, logarithmic average not more than	50 /100 ml	

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free of Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

HOUSTON SHIP CHANNEL–MORGANS POINT TO SAN JACINTO MONUMENT

(MEASURED AT MORGANS POINT IN CONFROMANCE WITH TWQB ORDER 65-9)

0906

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

CLEAR LAKE

(SEWAGE EFFLUENTS DIVERTED)

0907

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	5,000 mg/l
B.	Sulphate, average not to exceed	700 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	12,000 mg/l
D.	B.O.D., average not to exceed	3.0 mg/l
E.	Dissolved Oxygen, not less than	6.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	70 /100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

CLEAR LAKE
(SEWAGE EFFLUENTS DIVERTED)

0907

Water Quality is deemed suitable for the following uses among others:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation
- Industrial Cooling Water

Known water uses:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation

TEXAS CITY SHIP CHANNEL

(MONITORED AT GALVESTON BAY SURVEY STATION A-92, NORTHWEST OF SNAKE ISLAND)

0908

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

These requirements relate to the surface water layer. The salinity of the underlying saline waters will approach that of the contiguous bay or coastal zone. Where there is no surface water layer or where mixing has occurred, judgment must be applied. In some streams, salt water barriers may prevent the intrusion of marine waters.

A.	Chloride, average not to exceed	17,000 mg/l
B.	Sulphate, average not to exceed	2,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	35,000 mg/l
D.	B.O.D., average not to exceed	8.0 mg/l
E.	Dissolved Oxygen, not less than	3.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	1,000 /100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

TEXAS CITY SHIP CHANNEL
(MONITORED AT GALVESTON BAY SURVEY STATION A-92, NORTHWEST OF SNAKE ISLAND)

0908

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation

EAST BAY

1101

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	12,000 mg/l
B.	Sulphate, average not to exceed	1,200 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	25,000 mg/l
D.	B.O.D., average not to exceed	3.0 mg/l
E.	Dissolved Oxygen, not less than	6.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	70/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

EAST BAY

1101

Water Quality is deemed suitable for the following uses among others:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation
- Industrial Cooling Water

Known water uses:

- Contact Recreation
- Non-Contact Recreation
- Propagation of Fish and Wildlife
- Fishing
- Aesthetics
- Navigation

GALVESTON BAY

(EAST OF HOUSTON SHIP CHANNEL, BOUNDED BY CHANNEL MARKER 68, FISHER SHOALS DAY BEACON #1, LONE OAK BAYOU, SMITH POINT, HANNA REEF AND BOLIVAR PENINSULA)

1102

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A. Chloride, average not to exceed 12,000 mg/l
B. Sulphate, average not to exceed 1,200 mg/l
C. Filterable Residue, average not to exceed (Total Dissolved Solids) 25,000 mg/l
D. B.O.D., average not to exceed 4.0 mg/l
E. Dissolved Oxygen, not less than 6.0 mg/l
F. pH Range 7.0-9.0
G. MPN, logarithmic average not more than 70/100 ml
H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)
J. Free or Floating Oil – Substantially free from oil.
K. Foaming or Frothing Material – None of a persistent nature.
L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.
M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

GALVESTON BAY

(EAST OF HOUSTON SHIP CHANNEL, BOUNDED BY CHANNEL MARKER 68, FISHER SHOALS DAY BEACON #1, LONE OAK BAYOU, SMITH POINT, HANNA REEF AND BOLIVAR PENINSULA

1102

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation

TRINITY BAY AND GALVESTON BAY
(EAST OF HOUSTON SHIP CHANNEL AND NORTH OF CHANNEL MARKER 68 AND FISHER SHOALS DAY BEACON #1)

1103

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	10,000 mg/l
B.	Sulphate, average not to exceed	700 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	20,000 mg/l
D.	B.O.D., average not to exceed	5.0 mg/l
E.	Dissolved Oxygen, not less than	5.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	70/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

TRINITY BAY AND GALVESTON BAY

(EAST OF HOUSTON SHIP CHANNEL AND NORTH OF CHANNEL MARKER 68 AND FISHER SHOALS DAY BEACON #1)

1103

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

GALVESTON BAY

(WEST OF THE HOUSTON SHIP CHANNEL)

1104

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	12,000	mg/l
B.	Sulphate, average not to exceed	1,500	mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	25,000	mg/l
D.	B.O.D., average not to exceed	6.0	mg/l
E.	Dissolved Oxygen, not less than	5.0	mg/l
F.	pH Range	7.0-9.0	
G.	MPN, logarithmic average not more than	70/100 ml	

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

GALVESTON BAY
(WEST OF THE HOUSTON SHIP CHANNEL)

1104

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

WEST BAY
(EAST OF KARANKAWA REEF)

1105

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	16,000 mg/l
B.	Sulphate, average not to exceed	2,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	32,000 mg/l
D.	B.O.D., average not to exceed	3.0 mg/l
E.	Dissolved Oxygen, not less than	5.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	70/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that waters entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

WEST BAY

(EAST OF KARANKAWA REEF)

1105

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation

WEST BAY
(WEST OF KARANKAWA REEF)

1106

(THE GENERAL STATEMENT IS AN INTEGRAL PART OF THE FOLLOWING REQUIREMENTS.)

A.	Chloride, average not to exceed	16,000 mg/l
B.	Sulphate, average not to exceed	2,000 mg/l
C.	Filterable Residue, average not to exceed (Total Dissolved Solids)	32,000 mg/l
D.	B.O.D., average not to exceed	2.5 mg/l
E.	Dissolved Oxygen, not less than	6.0 mg/l
F.	pH Range	7.0-9.0
G.	MPN, logarithmic average not more than	70/100 ml

H. Temperature (See General Statement). Fall, winter, and spring, not to exceed a 4°F. rise in the representative temperature above natural conditions. Summer, not to exceed a 1.5°F. rise in the representative temperature above natural conditions.

This temperature requirement is a requirement of the Federal Water Pollution Control Administration.

I. Toxicity and Toxic Materials – These waters shall not exhibit either acute or chronic toxicity (or other harmful effect) to human, animal, or aquatic life to such an extent as to interfere with uses of the waters. (See General Statement)

J. Free or Floating Oil – Substantially free from oil.

K. Foaming or Frothing Material – None of a persistent nature.

L. Other – The control of other substances not heretofore mentioned will be guided by the U.S. Public Health Service manual "Sanitation of Shellfish Growing Areas", 1965 revision. Where waters are not shellfish growing areas, it is required only that water entering or contiguous to a shellfish growing area not interfere with the shellfish growing area.

M. Radioactive Materials – Levels of ionizing radiation and radioactive materials of all kinds, from both dissolved and suspended matter, shall be regulated by the Texas Radiation Control Act, Article 4590 (f), Revised Civil Statutes of Texas, and the Texas Regulations for Control of Radiation issued thereunder.

WEST BAY

(WEST OF KARANKAWA REEF)

1106

Water Quality is deemed suitable for the following uses among others:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation
Industrial Cooling Water

Known water uses:

Contact Recreation
Non-Contact Recreation
Propagation of Fish and Wildlife
Fishing
Aesthetics
Navigation

National Shellfish Sanitation Program
Manual of Operations

Part I

Sanitation of Shellfish Growing Areas

1965 Revision
Edited by
Leroy S. Houser, Sanitarian Director

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Environmental Engineering and Food Protection
Shellfish Sanitation Branch
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This is a revised edition published previously under the title: Cooperative Program for the Certification of Interstate Shellfish Shippers, Part I, Sanitation of Shellfish Growing Areas, 1962 Revision.

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LIST OF PREVIOUS EDITIONS OF MANUAL OF OPERATIONS FOR NATIONAL SHELLFISH SANITATION PROGRAM—NOW SUPERSEDED

1925. Supplement No. 53 to Public Health Reports November 6, 1925 "Report of Committee on Sanitary Control of the Shellfish Industry in the United States".

1937. U.S. Public Health Service Minimum Requirements for Approval of State Shellfish Control Measures and Certification for Shippers in Interstate Commerce (Revised October 1937).

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1957. Manual of Recommended Practice for Sanitary Control of the Shellfish Industry (Part II: Sanitation of the Harvesting and Processing of Shellfish). Printed as Part II of Public Health Service Publication No. 33.

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Contents

Page

FOREWORD vii

INTRODUCTION 1

DEFINITIONS 3

SECTION A—General Administrative Procedures 5
- 1. State Laws and Regulations 5
- 2. Administrative Procedures To Be Used by States 6
- 3. Intrastate Sale of Shellfish 8

SECTION B—Laboratory Procedures 9
- 1. Bacteriological 9
- 2. Toxicological 9
- 3. Chemical and Physical 9

SECTION C—Growing Area Survey and Classification 10
- 1. Sanitary Survey of Growing Areas 10
- 2. Classification of Growing Areas 12
- 3. Approved Areas 13
- 4. Conditionally Approved Areas 15
- 5. Restricted Areas 18
- 6. Prohibited Areas 19
- 7. Closure of Areas Due to Paralytic Shellfish Poison 19

SECTION D—Preparation of Shellfish for Marketing 21
- 1. Relaying 21
- 2. Controlled Purification 22

SECTION E—Control of Harvesting From Closed Areas 24
- 1. Identification of Closed Areas 24
- 2. Prevention of Illegal Harvesting From Closed Areas 24
- 3. Depletion of Closed Areas 25

APPENDIX A. Bacteriological Criteria for Shucked Oysters at the Wholesale Market Level 26

APPENDIX B. In Preparation ....

APPENDIX C. In Preparation ....

REFERENCES 28

INDEX 31

FOREWORD

A Declaration of Principles

The National Shellfish Sanitation Program is an unusual teaming of State and Federal resources to preserve and manage a natural resource for a beneficial use. Although the current program is of comparatively recent origin, its development can be traced back through several centuries of American history. When the European colonists arrived they found almost unimagined natural wealth. Forests, rich agricultural land, minerals, and space itself, were present in quantities and a variety previously unknown. To these settlers one of the most valuable and readily useable of these natural resources was the food resources of the sea, particularly the estuaries. It is not surprising that shellfish were foremost among their staple food items.

The value of these renewable natural resources to the early settlers was reflected in colonial legislation designed to encourage their wise use. In 1658—over 300 years ago—the Dutch council of New Amsterdam passed an ordinance regulating the taking of oysters from the East River. Other early legislation, including that of New York (1715), New Jersey (1730), and Rhode Island (1734), was designed to regulate harvesting, presumably as conservative measures to guarantee a continuing supply.

The public health problems which were associated with shellfish in the United States in the first two decades of the present century brought a new dimension to natural resource utilization; i.e., shellfish could not be used for food unless of acceptable sanitary quality. This concept was clearly recognized in the Public Health Service sponsored conference of 1925 in which the concepts of the present cooperative program were first outlined and the administrative foundation put down. All parties seemed to recognize, and accept as fact, the premises that: (1) shellfish represented a valuable natural food resource; (2) the cultivation, harvesting, and marketing of this food resource were valuable components in the financial bases of many coastal communities; (3) a State and Federal program was necessary to permit the safe use of this resource; and (4) the transmission of disease by shellfish was preventable and therefore not to be tolerated. It is significant that the founders of this program did not take the parochial stand that the only completely safe way to prevent disease transmission by shellfish was to prohibit its use. Instead, they held that this beneficial use of the estuaries was in the best public interest, and that sanitary controls should be developed and maintained which would allow safe use. These concepts were recognized in the program which evolved following the report of the "Committee on Sanitary Control of the Shellfish Industry in the United States" in 1925.

In 1954 the Surgeon General of the U.S. Public Health Service called a second national conference to discuss shellfish sanitation problems. Specifically, the 1954 conference addressed itself to the questions of the practicality and need for this tripartite program. There was general agreement that, despite the profusion of technical problems, the basic concepts were sound and that it was in the public interest to maintain the program. Thus, the presence of an irrevocable bond between the application of sanitary controls in the shellfish industry and the continuing beneficial use of a renewable natural resource was again confirmed.

Despite this long established relationship the national program has tended to neglect the second of these biphasic goals—use of a valuable natural resource—and to concentrate on the negative policy of closure of areas of unsuitable sanitary quality. Little effort has been made by the program to develop a compensatory element which would encourage corrective action by State or Federal agencies. Similarly, the program has not taken a position on the use of conservation law even when it was known that this would increase the program's consumer protection confidence factor.

In recognition of past history of the shellfish industry in the United States and of the relationship of the National Shellfish Sanitation Program to the effective use of this natural resource, the 1964 Shellfish Sanitation Workshop endorses the following principles:

1. Shellfish are a renewable, manageable natural resource of significant economical value to many coastal communities, and which should be managed as carefully as are other natural resources such as forests, water, and agricultural lands.
2. Shellfish culture and harvesting represents a beneficial use of water in the estuaries. This use should be recognized by State and Federal agencies in planning and carrying out pollution prevention and abatement programs and in comprehensive planning for the use of these areas.
3. The goals of the National Shellfish Sanitation Program are: (1) the continued safe use of this natural resource and (2) active encouragement of water quality programs which will preserve all possible coastal areas for this beneficial use.

It is the conviction of the 1964 National Shellfish Sanitation Workshop that survival of the shellfish industry is in the best public interest; that by application of the above principles on a State-by-State basis shellfish can continue to be used safely as food and to make a valuable contribution to the economic structure of the Nation both in the immediate present and in the foreseeable future.

Introduction

In 1925 State and local health authorities and representatives of the shellfish industry requested the Public Health Service to exercise supervision over the sanitary quality of shellfish shipped in interstate commerce. In accordance with this request, a cooperative control procedure was developed. In carrying out this cooperative control, the States, the shellfish industry, and the Public Health Service, each accept responsibility for certain procedures as follows.

1. Procedures To Be Followed by the State.—Each shellfish-shipping State adopts adequate laws and regulations for sanitary control of the shellfish industry, makes sanitary and bacteriological surveys of growing areas, delineates and patrols restricted areas, inspects shellfish plants, and conducts such additional inspections, laboratory investigations, and control measures as may be necessary to insure that the shellfish reaching the consumer have been grown, harvested, and processed in a sanitary manner. The State annually issues numbered certificates to shellfish dealers who comply with the agreed-upon sanitary standards, and forwards copies of the interstate certificates to the Public Health Service.

2. Procedures To Be Followed by the Public Health Service.—The Public Health Service makes an annual review of each State's control program including the inspection of a representative number of shellfish-processing plants. On the basis of the information thus obtained, the Public Health Service either endorses or withholds endorsement of the respective State control programs. For the information of health authorities and others concerned, the Public Health Service publishes a semimonthly list of all valid interstate shellfish-shipper certificates issued by the State shellfish-control authorities.

3. Procedures To Be Followed by the Industry.—The shellfish industry cooperates by obtaining shellfish from safe sources, by providing plants which meet the agreed-upon sanitary standards, by maintaining sanitary plant conditions, by placing the proper certificate number on each package of shellfish, and by keeping and making available to the control authorities records which show the origin and disposition of all shellfish.

The fundamental components of this National Shellfish Sanitation Program were first described in a *Supplement to Public Health Reports*, "Report of Committee on Sanitary Control of the Shellfish Industry in the United States" (1925). This guide for sanitary control of the shellfish industry was revised and reissued in 1937 and again in 1946. It was separated into two parts by publication of Part II, Sanitation of the Harvesting and Processing of Shellfish in 1957 and by publication in 1959, of Part I, Sanitation of Shellfish Growing Areas. The need for a specialized program of this nature was reaffirmed at the National Conference on Shellfish Sanitation held in Washington, D.C., in 1954 (*1*) and at the Shellfish Sanitation Workshop held in 1956 (*2*), 1958 (*3*), 1961 (*67*) and 1964 (*68*).

This edition of the shellfish sanitation manual has been prepared in cooperation with the State shellfish control authorities in all coastal States, food control authorities in the inland States, interested Federal agencies, Canadian Federal departments, the Oyster Institute of North America, the Pacific Coast Oyster Growers Association, and the Oyster Growers and Dealers Association of North America.

Since the growing and processing of shellfish are two distinct phases of operation in the shellfish industry, the manual has been prepared in two parts: I: Sanitation of Shellfish-Growing Areas; and II: Sanitation of the Harvesting and Processing of Shellfish. This, Part I of the manual, is intended as a guide for the preparation of State shellfish sanitation laws and regulations, and for sanitary control of the growing, relaying, and purification of shellfish. It is intended that States participating in the National Shellfish Sanitation program for the certification of interstate shellfish shippers will be guided by this manual in exercising sanitary supervision over shellfish growing, relaying, and purification, and in the issuing of certificates to shellfish shippers.

The manual will also be used by the Public Health Service in evaluating State shellfish sanitation programs to determine if the programs qualify for endorsement. Part III of the manual, "Public Health Service Appraisal of State Shellfish Sanitation Programs", sets forth appraisal procedures in evaluating State shellfish sanitation programs and is based on the requirements contained in parts I and II.

The provisions of this manual were accepted at the Shellfish Sanitation Workshop held in Washington, November 17–19, 1964, and unless otherwise stated become effective 60 days after publication (*68*).

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Definitions

And/or.—Where this term is used, *and* shall apply where possible; otherwise, *or* shall apply.

Area, growing.—An area in which market shellfish are grown.

Coliform group.—The coliform group includes all of the aerobic and facultative anaerobic, Gram-negtative, non-spore-forming bacilli which ferment lactose with gas formation within 48 hours at 35° C. Bacteria of this group which will produce gas from E. C. medium within 24 hours at 44.5° C. in a water bath will be referred to as fecal coliforms.

Controlled purification.—The process of removing contamination from whole live shellfish acquired while growing in polluted areas.

National shellfish sanitation program.—The cooperative State-PHS-Industry program for the certification of interstate shellfish shippers as described in Public Health Service Publication Number 33, *National Shellfish Sanitation Program Manual of Operations*, Parts I and II.

Depletion.—The removal of all market-size shellfish from an area.

Most probable number (abbreviated MPN).—The MPN is a statistical estimate of the number of bacteria per unit volume, and is determined from the number of positive results in a series of fermentation tubes. A complete discussion of MPN determinations and computations, including MPN tables, can be found in the American Public Health Association publication "Standard Methods for the Examination of Water and Waste Water" (*4*) (*5*).

Population equivalent (coliform).—A quantity of sewage containing approximately 160×10^9 coliform group bacteria. This is approximately equal to the per capita per day contribution of coliforms as determined in a metropolitan sewerage system (*6*) (*7*) (*8*).

Sanitary survey.—The sanitary survey is the evaluation of all factors having a bearing on the sanitary quality of a shellfish growing area including sources of pollution, the effects of wind, tides, and currents in the distribution and dilution of the polluting materials, and the bacteriological quality of the water.

Shellfish.—All edible species of oysters, clams, or mussels, either shucked or in the shell, fresh or frozen.

Shellfish, market.—Shellfish which are, may be, or have been harvested and/or prepared for sale for human consumption as a fresh or frozen product.

State shellfish control agency.—The State agency or agencies having legal authority to classify shellfish growing areas and/or to issue permits for the interstate shipment of shellfish in accord with the provisions of this manual.

State shellfish patrol agency.—The State agency having responsibility for the patrol of shellfish growing areas.

Transplanting.—The moving of shellfish from one area to another area.

Section A

GENERAL ADMINISTRATIVE PROCEDURES

1. State Laws and Regulations.—State laws or regulations shall provide an adequate legal basis for sanitary control of all interstate phases of the shellfish industry. This legal authority shall enable one or more departments or agencies of the State to classify all coastal waters for shellfish harvesting on the basis of sanitary quality; effectively regulate the harvesting of shellfish; effectively prosecute persons apprehended harvesting shellfish from restricted, prohibited, or nonapproved areas; regulate and supervise the shipment and storage of shell stock, and the shucking, packing, and repacking of shellfish; make laboratory examinations of shellfish; seize, condemn, or embargo shellfish; and restrict the harvesting of shellfish from particular areas and suspend interstate shipper certificates in public-health emergencies.

Satisfactory compliance.—This item will be satisfied when the State has legal authority to—

a. Classify all actual or potential shellfish growing areas as to their suitability for shellfish harvesting on the basis of sanitary quality as defined in section C of this manual. (It is strongly recommended that a State permit be required for the growing of shellfish, and that such permits be revocable or subject to suspension for just cause. It is also recommended that the State have authority to regulate the discharge of sewage, radioactive, and other toxic wastes from boats in the vicinity of approved shellfish growing areas.)

b. Control the harvesting of shellfish from areas which are contaminated or which contain marine shellfish poisons. To be effective this authority must allow the State to—

(1) Patrol growing areas.

(2) Apprehend persons violating the restrictions.

(3) Effectively prosecute persons apprehended harvesting shellfish from *restricted* or *prohibited* areas. (Penalties for such violations should be sufficient to discourage illegal harvesting.)

c. Regulate and supervise relaying, depletion, wet storage, and controlled purification as described in this manual if these techniques are used.

d. Require that shell stock in storage or in transit from the growing area to the certified shipper be protected against contamination; i.e., every person, firm, or corporation that handles shellfish up to the certified shipper will be subject to sanitary control by an official agency but will not necessarily be required to have a State shellfish permit.

e. Prohibit national program shippers from possessing or selling shellfish from out-of-State sources unless such shellfish have been produced in accord with cooperative program requirements.

f. Regulate the operations of shucker-packers, repackers, shell stock shippers and reshippers in accord with the applicable provisions of part II of this manual.

g. Restrict the harvesting of shellfish from specific areas, and suspend interstate shipper certificates in a public-health emergency. **Administrative procedures required in connection with such emergency actions should not require more than one day to complete.**

h. Prevent the sale, shipment, or possession of shellfish which cannot be identified as having been produced in accord with national program requirements or which are otherwise unfit for human consumption, and to condemn, seize, or embargo such shellfish. This authority need not be specific for shellfish and may be included in other State food laws.

Public-health explanation.—The National Program was developed by the 1925 Conference on Shellfish Pollution to meet the specific public-health need resulting from the 1924–25 typhoid epidemic (*9*).

However, the National Program has gone beyond the original objective of insuring that shellfish shipped interstate would not be the cause of communicable disease. Thus, in the 1940's, paralytic shellfish poison became a matter of public-health concern and steps were taken to protect the public against this hazard. In 1957 it was recognized that shellfish might concentrate certain radionuclides and that a radiation surveillance activity might become a necessary adjunct to the established procedures.

To accomplish these public-health objectives the State must supervise all phases of the growing, harvesting, transportation, shucking-packing, and repacking of shellfish to be shipped interstate. It is also important that shellfish be properly refrigerated and protected against contamination during interstate shipment. This is not easily accomplished by the State of origin although certified shippers are required to pack shellfish in containers which will protect them against contamination.

If State supervision is to be effective all phases of the activity must be supported by legal authority. This authority may be either a specific law or regulation. The success with which the State is able to regulate the several components of the shellfish industry provides a measure of the adequacy of the statutory authority.

The unique nature of shellfish as a food also makes it necessary that the State shellfish control agency have authority to take immediate emergency action to halt harvesting or processing of shellfish without recourse to lengthy administrative procedures. As examples, a State may find it necessary to close a shellfish growing area within hours of a breakdown in a sewage treatment plant or the unexpected finding of paralytic shellfish poison.

Periodic revisions of State shellfish laws or regulations may be necessary to cope with new public-health hazards and to reflect new knowledge. Examples of changes or developments which have called for revision of State laws include the wide-scale use of pleasure boats with the resulting probability of contamination of shellfish growing areas with fresh fecal material, the conditionally approved area concept resulting from the construction of sewage treatment works, and the apparent ability of shellfish to concentrate certain radionuclides.

Experience has demonstrated that all actual and potential shellfish growing waters of the State must be classified as to their sanitary suitability for shellfish harvesting. Harvesting should be permitted only from those areas which have been found by sanitary survey to meet the sanitary criteria of this manual. Harvesting should accordingly be specifically prohibited from areas which do not meet the criteria, or which have not been surveyed.

2. General Administrative Procedures To Be Used by States.—States shall keep records which will facilitate Public Health Service review of their shellfish sanitation programs and shall assist the Service in making such reviews. States shall not certify shippers for interstate shipment unless the shipper complies substantially with the construction requirements of part II of this manual and maintains a sanitation rating of at least 80 percent during periods of operation. Shippers not meeting these requirements will not be eligible for inclusion on the Public Health Service list of State-certified shellfish shippers. National Program standards shall be applied to all actual and potential growing areas, all shellfish harvesters, and all persons handling shell stock prior to its delivery to the national program certified shipper. When two or more State agencies are involved in the sanitary control of the shellfish industry, a clear statement of responsibility of each agency should be developed.

Satisfactory compliance.—This item will be satisfied when—

a. National Program requirements are applied to all actual and potential shellfish growing areas.

b. National Program requirements are applied to all commercial market shellfish harvesters.

c. National Program requirements are applied to all persons handling the shellfish prior to its delivery to the interstate shipper.

d. Interstate shellfish shipper certificates are issued only to those establishments substantially meeting the construction requirements of part II of this manual and which maintain a plant sanitation rating of at least 80 percent during periods of operations. (The State shellfish control agency shall suspend or revoke certificates if a plant sanitation rating drops below 80 percent or if any individual sanitation item is violated repeatedly.) Ratings will be determined on the basis of compliance withe the applicable provisions of part II of this manual as measured by an inspection report comparable to that contained in appendix A of part II.

e. The following records are kept of shellfish sanitation activities as required in sections C, D, and E, Part I, of this manual and when monthly summaries of State patrol activities are forwarded to the Public Health Service regional office:

(1) Individual growing area files. (Areas may be defined by either geographic or political boundaries.)

(2) Patrol activities, including arrests, prosecutions, and the results of prosecutions.

(3) Plant inspections. Shucker-packers and repackers shall ordinarily be inspected at least monthly. Shell stock shippers and reshippers shall be inspected at a frequency which will afford adequate public-health supervision of their operations. A central inspection-report file should be maintained by the State.

f. The following guidelines are observed by the State in issuing interstate shellfish certificates.

(1) Certificate content. Each certificate should give the following information:

Name. (The usual business name and alternative names that should appear on the interstate shellfish shippers list, hereafter called "list.")

Address. (A business and/or mailing address in the State issuing the certificate. This address indicates where records are kept and where inspection may be arranged.)

Certificate Number. (A number shall be assigned for each business unit. Suffix or prefix letters may not be used to differentiate between two or more plants of a given shipper.)

Classification. (The shipper classification should be indicated by a symbol: i.e., shucker-packer, SP; repacker, RP; shell stock, SS; or reshipper, RS. Only one classification should be used. The single classification will cover all proposed operations which the shipper is qualified to perform.)

Expiration Date. (All certificates in a State should expire on the same date, preferably the last day of a month. This date will be shown on the "list". All certificates will be automatically withdrawn from the "list" on the date of expiration unless new certificates have been received by Public Health Service headquarters office. If the date of expiration coincides with the date of issue for the "list" the certificates expiring on the date of issue will be deleted.)

Certifying Officer. (Each certificate is signed by a responsible State official.)

(2) Certificate changes. A change in an existing, unexpired certificate should be made by issuing a corrected certificate.

(3) Interstate shipment before listing. The shipper should be informed of the probable date his name will appear on the "list" and should be advised against making interstate shipment prior to that date. (If shipments must be made before the appearance of the shipper's name on the "list", the Public Health Service will notify the applicable receiving States if the names and addresses of the expected receivers are indicated in advance by the State when the certificate is forwarded to the Public Health Service.)

(4) State cancellation, revocation, or suspension of interstate shipper certificates. If a State revokes, cancels, or suspends an interstate shellfish shipper certificate, the Public Health Service regional office should be immediately notified, preferably by telephone or telegram, with a following confirmatory letter.

(5) Mailing list for interstate shellfish shipper list. Names of persons, business units, organizations, or agencies, desiring copies of the "list", and requests for information concerning the "list" should be sent to the appropriate Public Health Service regional office. Recipients will be circularized periodically to determine if they still have use for the "list".

g. The appropriate Public Health Service regional office is notified by the State of any revision in growing area classification. The notification shall so describe the area that it may be readily located on Coast and Geodetic Survey charts.

h. State shellfish plant inspectors are provided with the following inspection equipment: standardized inspection forms, thermometer, chlorine test kit, and light meter.

i. Interdepartmental memoranda of understanding have been developed which will define the responsibilities of each State agency in maintaining adequate sanitary control of the shellfish industry in the State.

Public-health explanation.—The annual review of each participating State's shellfish sanitation activities is a fundamental Public Health Service responsibility in the National Program. The purpose of this review is to evaluate the adequacy and reliability of each individual State program in accord with the agreed-upon standards. The Service will endorse those State programs meeting the National Program standards and will publish and distribute a list of the names of the State certified shippers. However, if a State program does not meet the standards the program will not be endorsed. Names of nonparticipating States will be omitted from the Public Health Service list of State certified shellfish shippers.

Minimum plant sanitation standards for interstate shellfish shippers are described in part II of this manual. Experience has shown that absolute compliance with these minimum standards is not always attainable, particularly those items which relate to operating procedures. The establishment of the 80-percent plant sanitation score as a prerequisite for listing on the Public Health Service list of State certified shellfish shippers recognizes the fact that perfection is not always obtainable and, at the same time, provides a mechanism for excluding any plant which is not operated in a reasonably sanitary manner.

National program sanitary requirements should be applied to all actual and potential growing areas and all shellfish harvesters to insure that all shellfish available to certified dealers have been produced and harvested under acceptable sanitary conditions. It is also important that the shell stock be protected against contamination during the period between harvesting and delivery to the certified shipper.

3. Intrastate Sale of Market Shellfish.—Sanitary standards for intrastate shellfish shippers should be substantially equivalent to those of the national program.

Public-health explanation.—States may accept lower sanitary standards for shellfish sold intrastate than are required by the National Program. However, it has been found that small intrastate shippers may at times sell their product to interstate shippers if demand exceeds the supply of shellfish available to the latter. Because of the possibility that such substandard shellfish might be shipped interstate, the 1954 National Conference on Shellfish Sanitation recommended that National Program standards be applied to all shellfish production and processing (*1*). The 1958 Shellfish Sanitation Workshop also strongly recommended the use of substantially equivalent standards for intra- and inter-state shellfish shippers (*3*).

Section B

LABORATORY PROCEDURES

1. Bacteriological.—American Public Health Association Recommended Procedures for the Examination of Sea Water and Shellfish shall be followed in the collection and transportation of samples of shellfish and shellfish waters for bacteriological examination and in the laboratory examination of such samples.[1]

Satisfactory compliance.—This item will be satisfied when current American Public Health Association Recommended Procedures for the Examination of Sea Water and Shellfish are followed in the bacteriological examination of shellfish and shellfish waters.

Public-health explanation.—Experience with the bacteriological examination of shellfish and shellfish growing waters has indicated that minor differences in laboratory procedures or techniques will cause wide variations in the results. Variations in results may also be caused by improper handling of the sample during collection or transportation to the laboratory (*10*). The American Public Health Association Recommended Procedures for the Examination of Sea Water and Shellfish, which are revised periodically, offer a reliable way of minimizing these variations (*62*). (National Program required use of a standard procedure for the bacteriological examination of shellfish and shellfish waters should not discourage laboratories from working on new methods of sample handling or analysis.)

2. Toxicological.—A recognized procedure shall be used in the assay for paralytic shellfish poison.

Satisfactory compliance.—This item will be satisfied when current Association of Official Agricultural Chemists official methods are followed in the bioassay for paralytic shellfish poison.

Public-health explanation.—It has been demonstrated that significant variations in bioassay results will be caused by minor changes in procedures. If reliable results are to be obtained it is essential that the test procedures be standardized and that variations due to use of strains of mice be minimized (*11*). The official procedure for the bioassay for paralytic shellfish poison adopted by the Association of Official Agricultural Chemists minimizes these variations (*66*). A method of analysis for ciguatera poison in shellfish has been developed (*12*).

3. Chemical and Physical.—Standard laboratory methods shall be used for all salinity, radionuclide, and other chemical and physical determinations made on shellfish or shellfish waters in conjunction with National Program activities. Results shall be reported in standard units.

Satisfactory compliance.—This item will be satisfied when—

a. Chemical and physical measurements on shellfish and shellfish waters are made in accord with accepted laboratory techniques.

b. Results of all chemical and physical determinations are expressed in standard units. (For example, salinity should be expressed in parts per thousand rather than hydrometer readings.)

Public-health explanation.—Standardized laboratory procedures are most apt to produce results in which the State shellfish control agency can have confidence, and facilitate comparative evaluation of data. The need for adherence to standardized procedures should not discourage laboratories from experimental use of nonstandard methods.

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[1] Material which may be useful in interpretation of results of bacteriological examination of shellfish is contained in appendix A.

Section C

GROWING AREA SURVEY AND CLASSIFICATION

1. Sanitary Surveys of Growing Areas.—A sanitary survey shall be made of each growing area prior to its approval by the State as a source of market shellfish or of shellfish to be used in a controlled purification or relaying operation. The sanitary quality of each area shall be reappraised at least biennially and, if necessary, a resurvey made. Ordinarily, resurveys will be much less comprehensive than the original survey since it will only be necessary to bring the original information up to date. Records of all original surveys and resurveys of growing areas shall be maintained by the State shellfish control agency, and shall be made available to Public Health Service review officers upon request.

Satisfactory compliance.—This item will be satisfied when—

a. A sanitary survey has been made of each growing area in the State prior to initial approval of interstate shipments of shellfish from that area. A comprehensive sanitary survey shall include an evaluation of all sources of actual or potential pollution on the estuary and its tributaries, and the distance of such sources from the growing areas; effectiveness and reliability of sewage treatment works; the presence of industrial wastes, pesticides, or radionuclides which would cause a public-health hazard to the consumer of the shellfish; and the effect of wind, stream flow, and tidal currents in distributing polluting materials over the growing area.[2] The thoroughness with which each element must be investigated varies greatly and will be determined by the specific conditions in each growing area.

b. The factors influencing the sanitary quality of each approved shellfish growing area are reappraised at least biennially.[3] A complete resurvey should be made of each growing area in an approved category at least once every ten years; however, data from original surveys can be used when it is clear that such information is still valid.

c. A file which contains all pertinent sanitary survey information, including the dates and results of preceding sanitary surveys is maintained by the State shellfish control agency for each classified shellfish area.

d. The State agency having primary responsibility for this element of the national program develops a system for identification of growing areas.

Public-health explanation.—The positive relationship between sewage pollution of shellfish growing areas and enteric disease has been demonstrated many times (*13*) (*14*) (*15*) (*16*) (*17*) (*18*) (*63*) (*64*) (*65*). However, epidemiological investigations of shellfish-caused disease outbreaks have never established a direct numerical correlation between the bacteriological quality of water and the degree of hazard to health. Investigations made from 1914 to 1925 by the States and the Public Health Service—a period when disease outbreaks attributable to shellfish were more prevalent—indicated that typhoid fever or other enteric disease would not ordinarily be attributed to shellfish harvested from water in which not more than 50 percent of the 1 cc. portions of water examined were positive for coliforms,[4] *provided the areas were not subject to direct contamination with small amounts of fresh sewage which would not ordinarily be revealed by the bacteriological examination.*

Following the oyster-borne typhoid outbreak during the winter of 1924–25 in the United States (*19*) the national shellfish certification program was initiated by the States, the Public Health Service, and the shellfish industry (*9*). Water quality criteria were then stated as:

a. The area is sufficiently removed from major sources of pollution so that the shellfish would not be subjected to fecal contamination in quantities which might be dangerous to the public health.

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[2] In making the sanitary survey consideration should be given to the hydrographic and geographic characteristics of the estuary, the bacteriological quality of the growing area water and bottom sediments, and the presence and location of small sources of pollution, including boats, which might contribute fresh sewage to the area.

[3] The purpose of this reappraisal is to determine if there have been changes in stream flow, sewage treatment, populations, or other similar factors which might result in a change in the sanitary quality of the growing area. The amount of field work associated with such a reappraisal will depend upon the area under consideration and the magnitude of the changes which have taken place.

[4] An MPN of approximately 70 per 100 ml.

b. The area is free from pollution by even small quantities of fresh sewage. The report emphasized that bacteriological examination does not, in itself, offer conclusive proof of the sanitary quality of an area.

c. Bacteriological examination does not ordinarily show the presence of the coli-aerogenes group of bacteria in 1 cc. dilutions of growing area water.

The reliability of this three-part standard for evaluating the safety of shellfish-producing areas is evidenced by the fact that no major outbreaks of typhoid fever or other enteric disease have been attributed to shellfish harvested from waters meeting the criteria since they were adopted in the United States in 1925. Similar water quality criteria have been in use in Canada with like results. The available epidemiological and laboratory evidence gives little idea as to the margin of safety, but it is probably considerable as indicated by the virtual absence of reported shellfish caused enteric disease over a comparatively long period of time (*18*) (*20*) (*21*) (*65*) (*69*) from waters meeting this criteria.

The purpose of the sanitary survey is to identify and evaluate those factors influencing the sanitary quality of a growing area and which may include sources of pollution, potential or actual; the volume of dilution water; the effects of currents, winds and tides in disseminating pollution over the growing areas; the bacterial quality of water and bottom sediments; die out of polluting bacteria in the tributaries and the estuary; bottom configuration; and salinity and turbidity of the water. Sources of pollution include municipal sewage discharged into the estuary or inflowing rivers; sewage brought into the estuary by tides or currents; surface runoff from polluted areas; industrial wastes; and discharges from pleasure craft, fishing boats, naval vessels, and merchant shipping.

Bacteriological examination of the growing waters is an important component of the sanitary survey. In many instances the bacteriological and related salinity data will also provide valuable information on the hydrographic characteristics of an area.[5] [6]

Ideally, a large number of water samples for bacteriological examination should be collected at each station. However, in most instances this is not practical because of time and budget limitations, and accordingly only a limited number of samples can be collected. Therefore, sampling stations should be chosen which will provide a maximum of data, and which will be respresentative of the bacteriological quality of water in as wide an area as possible. Sample collection should be timed to represent the most unfavorable hydrographic and pollution conditions since shellfish respond rapidly to an increase in the number of bacteria or viruses in their environment (*25*) (*26*) (*70*) (*71*) (*72*) (*78*).

There is no specified minimum number of sampling stations, frequency of sampling, or total number of samples. Sampling results obtained over a period of several years can be used as a block of data provided at least 15 samples have been collected from each of a representative number of stations along the line separating approved from restricted growing areas and there have been no adverse changes in hydrographic or sanitary conditions. Only occasional bacteriological samples are necessary from areas which are shown to be free from pollution.

Experience with the shellfish certification program indicates a tendency to omit or de-emphasize some components of the sanitary survey unless a central State file of all shellfish sanitary surveys, reappraisals, and resurveys is maintained. This is particularly true where responsibility for shellfish sanitation is divided between two or more State agencies. Maintenance of a central State file for all shellfish sanitary survey information will also simplify the endorsement appraisal of State programs by the Public Health Service and will help prevent loss of old data which may be useful in evaluating the sanitary quality of an area.

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[5] Bacteria in an unfavorable environment die out in such a way that following an initial lag period there is a large percentage decline during the first few days. Descriptions of studies on bacteria dieout have been published by Greenberg (*22*) and Pearson (*23*). Dieoff has also been investigated by the Public Health Service Shellfish Sanitation Laboratory at Woods Hole, Mass., and Pensacola, Fla. Application of this principle may be helpful in predicting the quantity of pollution which will reach an area, and in establishing objective effluent quality criteria (*24*).

[6] In connection with the evaluation of sampling results, it should be noted that the MPN determination is not a precise measure of the concentration of bacteria (*4*). Thus, in repeated sampling from waters having a uniform density of bacteria varying MPN estimates will be obtained. The use of the tolerance factor 3.3 (applicable only to 5 tube decimal dilution MPN's) is one method of recognizing this variation. For example, in a body of water in which the median concentration of coliform bacteria is 70 per 100 ml., 95% of observed MPN's will be between 20 and 230 per 100 ml.; i.e., $70/3.3=21$ and $70\times3.3=230$.

Periodic reappraisals of the sanitary quality of shellfish producing areas are necessary to determine that environmental conditions are such that the original conclusions are still valid. A *resurvey* should be made within 1 year if the *reappraisal* shows a significant detrimental change.

2. Classification of Growing Areas.—All actual and potential growing waters shall be classified as to their public health suitability for the harvesting of market shellfish. Classification criteria are described in sections C–3, C–4, C–5, C–6, and C–7 of this manual. Except in emergency any upward revision of an area classification shall be preceded by a sanitary survey, resurvey, or reappraisal. A written analysis of the data justifying the reclassification shall be made a part of the area file.

Satisfactory compliance.—This item will be satisfied when—

a. All actual and potential growing waters in the State are correctly designated with one of the following classifications on the basis of sanitary survey information: *Approved; conditionally approved; restricted;* or *prohibited.*[7] [*]

b. Area classifications are revised whenever warranted by survey data.

c. Classifications are not revised upward without at least a file review, and there is a written record of such review in the area file maintained by the State shellfish control agency.

d. All actual and potential growing areas which have not been subjected to sanitary surveys shall be automatically classified as *prohibited.*

Public-health explanation.—The probable presence or absence of pathogenic organisms in shellfish waters is of the greatest importance in deciding how shellfish obtained from an area may be used. All actual and potential growing waters should thus be classified according to the information developed in the sanitary survey. Classification should not be revised upward without careful consideration of available data. Areas should be reclassified whenever warranted by existing data. A written justification for the reclassification simplifies Public Health Service appraisal of State programs.

A hypothetical use of the four recognized area classifications is shown in figure 1. This idealized situation depicts an estuary receiving sewage from two cities, "A" and "B." City "A" has complete sewage treatment including chlorination of effluent. City "B" has no sewage treatment. The estuary has been divided into five areas, designated by roman numerals, on the basis of sanitary survey information:

Approved

Area I. The sanitary survey indicates that sewage from cities "A" and "B" (even with the "A" sewage plant not functioning) would not reach this area in such concentration as to constitute a public-health hazard. The median coliform MPN of the water is less than 70/100 ml. The sanitary quality of the area is independent of sewage treatment at city "A."

Conditionally Approved

Area II. This area is of the same sanitary quality as area I; however, the quality varies with the effectiveness of sewage treatment at city "A." This area would probably be classified *prohibited* if city "A" had not provided sewage treatment.

Restricted

Area III. Sewage from "B" reaches this area, and the median coliform MPN of water is between 70 and 700 per 100 ml. Shellfish may be used only under specified conditions .

Prohibited

Area IV. Direct harvesting from this area is prohibited because of raw sewage from "B." The median coliform MPN of water may exceed 700/100 ml.

Area V. Direct harvesting from this area is prohibited because of possible failure of the sewage treatment plant. Closure is based on need for a safety factor rather than coliform content of water or amount of dilution water.

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[7] Closures may also be based on presence of Marine Toxins or other toxic materials.

[*] States may use other terminology in describing area classifications; provided, that the classification terms used are consistent with the intent and meaning of the words "approved", "conditionally approved", "restricted", or "prohibited".

3. Approved Areas.—Growing areas may be designated as *approved* when: (*a*) the sanitary survey indicates that pathogenic microorganisms, radionuclides, and/or harmful industrial wastes do not reach the area in dangerous concentration, and (*b*) this is verified by laboratory findings whenever the sanitary survey indicates the need. Shellfish may be taken from such areas for direct marketing.

Satisfactory compliance.—This item will be satisfied when the three following criteria are met:

a. The area is not so contaminated with fecal material that consumption of the shellfish might be hazardous, and

b. The area is not so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be hazardous (see section C, item 7, regarding toxins in shellfish growing areas), and

c. The coliform median MPN of the water does not exceed 70 per 100 ml., and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 ml. for a 5-tube decimal dilution test (or 330 per 100 ml., where the 3-tube decimal dilution test is used) in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. (Note: This concentration might be exceeded if less than 8 million cubic feet of a coliform-free dilution water are available for each population equivalent (*coliform*) of sewage reaching the area). The foregoing limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard (*19*) (*20*).[8]

Public-health explanation.—A review of epidemiological investigations of disease outbreaks attributable to the consumption of raw shellfish reveals that two general situations prevail[9] insofar as pollution of growing or storage areas are concerned.

(1) Gross sewage contamination of a growing or wet storage area. (A report of a 1910 outbreak of typhoid fever involving 41 persons notes that raw sewage from a city with a population of 30,000 was discharged only a few hundred feet away from clam beds and floats (*27*) (*28*). In 1947 a case of typhoid fever was attributed to clams harvested 200 yards from the outlet of a municipal sewage treatment plant (*29*). In the latter case, the coliform MPN of the harbor water exceeded 12,000 per 100 ml. and the area had been posted as closed to shellfish harvesting.)

(2) Chance contamination of a growing or wet storage area by fresh fecal material which may not be diffused throughout the entire area (*14*) (*16*) (*17*) (*19*) and therefore not readily detectable by ordinary bacteriological procedures. The possibility of chance contamination was noted by Dr. Gurion in his report on a 1902 typhoid outbreak, and who is quoted in Public Health Bulletin No. 86, as "there is a zone of pollution established by the mere fact of the existence of a populated city upon the banks of a stream or tidal estuary which makes the laying down of oysters and clams in these waters a pernicious custom if persisted in, because it renders these articles of food dangerous at times, and always suspicious". The 1956 outbreak of infectious hepatitis in Sweden (691 cases) attributed to oysters which were contaminated in a wet storage area is an example of such contamination (*16*). Similarly in 1939, 87 cases of typhoid were attributed to fecal contamination of a storage area by a typhoid carrier (*14*).

It is well established that shellfish from water having a median coliform MPN not exceeding 70 per 100 ml.[8] *and which is also protected against chance contamination with fecal material*, will not be involved in the spread of disease which can be attributed to initial contamination of the shellfish. This is not surprising since a water MPN of 70/100 ml. is equivalent to a dilution ratio of about 8 million cubic feet of coliform-free water per day for the fecal material from each person contributing sewage to the area. This tremendous volume of water is available in shellfish growing areas through

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[8] This MPN value is based on a typical ratio of coliforms to pathogens and would not be applicable to any situation in which an abnormally large number of pathogens might be present. Consideration must also be given to the possible presence of industrial or agricultural wastes in which there is an atypical coliform to pathogen ratio (*30*).

[9] There is a third general consideration in which shellfish may be contaminated through mishandling. This is not related to growing area sanitation and is considered in part II of this manual.

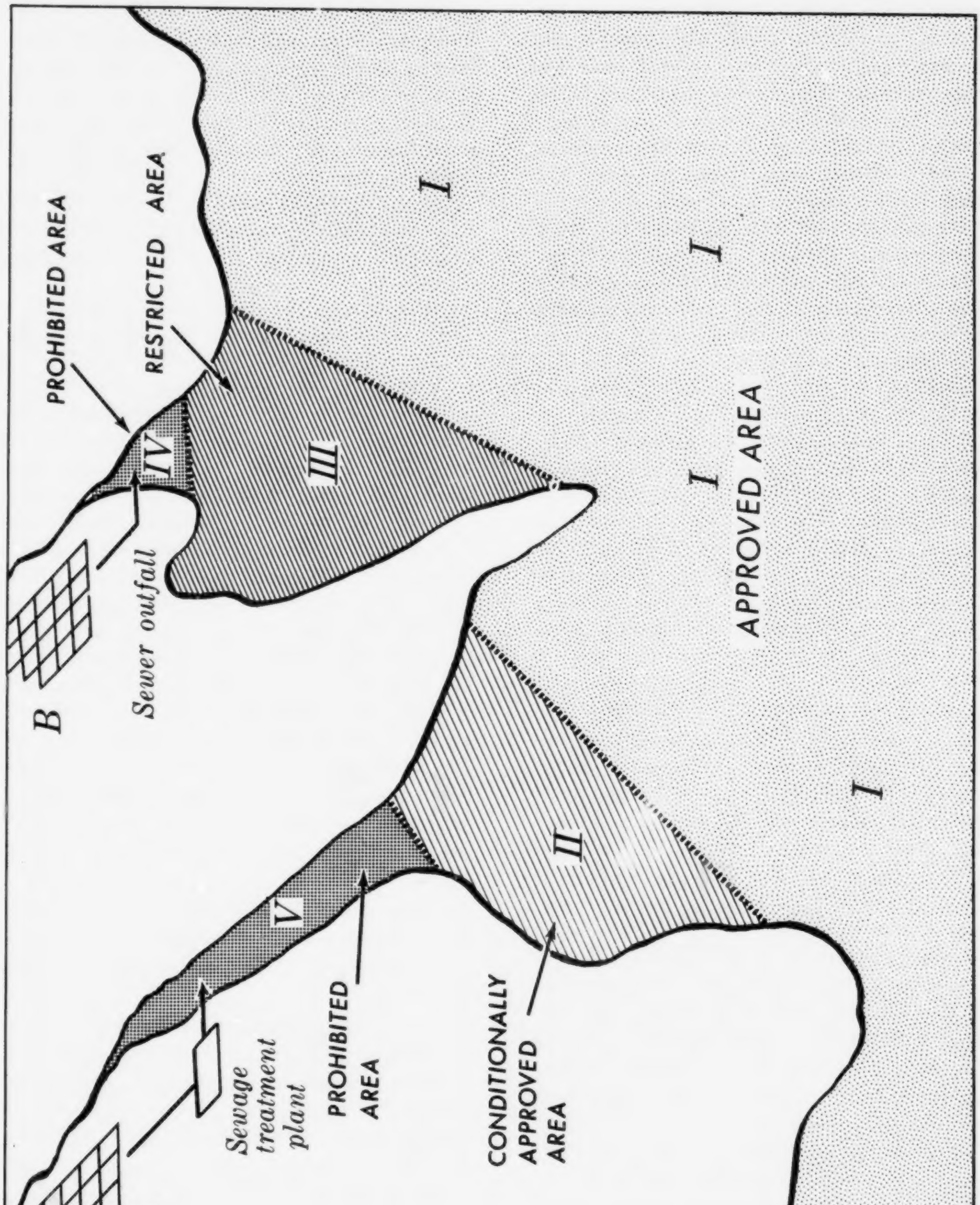
A
B
Sewage treatment plant
Sewer outfall
PROHIBITED AREA
RESTRICTED AREA
IV
III
I
I
I
APPROVED AREA
I
V
PROHIBITED AREA
II
CONDITIONALLY APPROVED AREA

FIGURE 1

tidal action which is constantly bringing unpolluted water into the area.[8]

Areas which are approved for direct market harvesting of shellfish which will be eaten raw must necessarily meet one general test; i.e, sewage reaching the growing area must be so treated, diluted, or aged that it will be of negligible public-health significance. This implies an element of time and distance to permit the mixing of the sewage or fecal material with the very large volume of diluting water and for a major portion of the microorganisms to die out. Studies of the natural die-off of microorganisms in an unfavorable marine environment have been summarized by Greenberg (*22*).

The effectiveness of sewage treatment processes must be considered in evaluating the sanitary quality of a growing area since the bacterial and viral content of the effluent will be determined by the degree of treatment which is obtained (*2*) (*73*) (*74*) (*75*). The results of bacteriological sampling must also be correlated with sewage treatment plant operation, and evaluated in terms of the minimum treatment which can be expected with a realization of the possibility of malfunctioning, overloading, or poor operation.

The presence of radionuclides in growing area waters may also have public-health significance since shellfish, along with other marine organisms, have the ability to concentrate such materials (*31*) (*32*) (*33*) (*34*). The degree to which radioisotopes will be concentrated depends upon the species of shellfish and the specific radioisotope. For example, it has been reported that the Eastern oyster has a concentration factor of 17,000 for Zn^{65} whereas the concentration factor in soft tissues for Sr^{89} is approximately unity (*31*) (*33*). The distribution of the radioisotope in the shellfish and the biological half-life are also variable. Sources of radioactive materials include fall-out, industrial wastes, and nuclear reactors. Limiting maximum permissible concentrations of radioactive materials expressed in terms of specific radioisotopes and unidentified mixtures in water and food have been established (*35*) (*36*). The current standard should be consulted in evaluating the public-health significance of detected radioactivity in market shellfish.

The bacterial quality of active shellfish will ordinarily be directly proportional to the bacterial quality of the water in which they grew; however, considerable variation in individual determinations may be expected. The coliform MPN's of the shellfish usually exceed those of the overlying water because shellfish filter large quantities of water to obtain food, thereby concentrating the suspended bacteria. This relationship will depend upon the shellfish species, water temperature, presence of certain chemicals, and varying capabilities of the individual animals.

4. Conditionally Approved Areas.—The suitability of some areas for harvesting shellfish for direct marketing is dependent upon the attainment of an established performance standard by sewage treatment works discharging effluent, directly or indirectly, to the area. In other cases the sanitary quality of an area may be effected by seasonal population, or sporadic use of a dock or harbor facility. Such areas may be classified as *conditionally approved.*

State shellfish control agencies shall establish *conditionally approved* areas only when satisfied that (a) all necessary measures have been taken to insure that performance standards will be met, and (b) that precautions have been taken to assure that shellfish will not be marketed from the areas subsequent to any failure to meet the performance standards and before the shellfish can purify themselves of polluting microorganisms.

Satisfactory compliance.—This item will be satisfied when—

a. The water quality requirements for an *approved* area are met at all times while the area is approved as a source of shellfish for direct marketing.

b. An operating procedure for *each conditionally approved* area is developed jointly by the State shellfish control agency, local agencies, including those responsible for operation of sewerage systems, and the local shellfish industry. The operating procedure should be based on an evaluation of each of the potential sources of pollution which may affect the area. The procedure should establish performance standards, specify necessary safety devices and measures, and define inspection and check procedures. (These procedures are described in more detail in the following public-health explanation.)

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[8] See footnote 8 on page 13.

c. A closed safety zone is established between the *conditionally approved* area and the source of pollution to give the State agency time to stop shellfish harvesting if performance standards are not met.

d. Boundaries of *conditionally approved* areas are so marked as to be readily identified by harvesters.

e. Critical sewerage system units are so designed, constructed, and maintained that the chances of failure to meet the established performance standards due to mechanical failure or overloading are minimized.

f. There is a complete understanding of the purpose of the *conditionally approved* classification by all parties concerned, including the shellfish industry. Successful functioning of the concept is dependent upon the wholehearted cooperation of all interested parties. If such cooperation is not assured the State should not approve the area for direct harvesting of market shellfish.

g. Any failure to meet the performance standards is immediately reported to the State shellfish control agency by telephone or messenger. In some instances States may find it desirable to delegate the authority for closing a *conditionally approved* area to a representative of the agency located in the immediate area.

h. The State immediately closes *conditionally approved* areas to shellfish harvesting following a report that the performance standards have not been met. The area shall remain closed until the performance standards can again be met plus a length of time sufficient for the shellfish to purify themselves so that they will not be a hazard to the public health. (See section D–1, "Relaying," for information on the length of time required for self-purification of shellfish.)

i. The State shellfish control agency makes at least two evaluations during the shellfish harvesting season of each *conditionally approved* area including inspection of each critical unit of the sewerage system to determine the general mechanical condition of the equipment, the accuracy of recording devices, and the accuracy of reporting by the operating agency.

j. It is discovered that failure to meet performance standards have not been reported by the operating agency, or if the performance standards are not met, the area will immediately revert to a *restricted* or *prohibited* classification.

k. All data relating to the operation of a *conditionally approved* area, including operation of sewerage systems, are maintained in a file by the State shellfish control agency.

Public-health explanation.—The *conditionally approved* classification is designed primarily to protect shellfish growing areas in which the water quality might undergo a significant adverse change within a short period of time.[10] The change might result from overloading or mechanical failure of a sewage treatment plant, or bypassing of sewage at a lift station.

Water quality in many growing areas in the more densely populated sections of the country is, to some degree, dependent upon the operation of sewage treatment plants. For example, the boundaries of an approved shellfish area might be determined during a period when a tributary sewage treatment plant is operating at a satisfactory level. If there is some interruption in treatment it follows that there will be some degradation in water quality in the growing area, which may justify a relocation of the boundaries. The degree of relocation would depend upon such items as the distance between the pollution source and the growing area, hydrography, the amount of dilution water, and the amount of pollution.

The concept is also applicable to other situations in which there may be a rapid or seasonal change in water quality. Examples of such situations include—

a. A growing area adjacent to a resort community. During the summer months the community might have a large population which might have an adverse effect on water quality. However, during the winter when there are few people in the community the water quality might improve sufficiently to allow approval of the area. In some States this is known as a seasonal closure.

b. A protected harbor in a sparsely settled area might provide anchorage for a fishing fleet several months a year. When the fishing fleet is in, the harbor water would be of poor sanitary quality; however, during the remainder of the year the quality of the harbor water might be satisfactory. The area would be approved for shellfish harvesting only when the fishing fleet is not using the harbor.

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[10] A natural disaster may also cause many sewage treatment plants to be out of service for an extended period of time. The *conditionally approved* area concept is not ordinarily concerned with such emergency situations.

c. The water quality in an area fluctuates with the discharge of a major river. During periods of high runoff the area is polluted because of decreased flow time in the river. However, during periods of low runoff the area might be of satisfactory quality and thus be approved for shellfish harvesting.

The establishment of *conditionally approved* areas might be considered whenever the potential for sewage contamination is such that the limiting water quality criteria for an *approved* area might be exceeded in less than one week due to a failure of sewage treatment, or other situations as described above.

The first step in determining whether an area should be placed in the *conditionally approved* classification is the evaluation of the potential sources of pollution in terms of their effect on water quality in the area. Potential sources of pollution include the following:

(1) Sewage treatment plants.

(*a*) Bypassing of all or part of sewage because of mechanical or power failure, hydraulic overloading, or treatment overloading.

(*b*) Reduced degree of treatment due to operational difficulties or inadequate plant.

(2) Sewage lift stations.

(*a*) Bypassing during periods of maximum flow due to inadequate capacity.

(*b*) Bypassing because of mechanical or power failure.

(3) Interceptor sewers or underwater outfalls.

(*a*) Exfiltration due to faulty construction.

(*b*) Leakage due to damage.

(4) Other sources of pollution.

(*a*) Sewage from merchant or naval vessels.

(*b*) Sewage from recreation use of area.

The second step in establishment of a *conditionally approved* area is the evaluation of each source of pollution in terms of the water quality standards to be maintained, and the formulation of performance standards for each installation having a significant effect on the sanitary quality of the area. Examples of performance standards might include:

(1) Bacteriological quality of effluent from sewage treatment plants. This might be stated in terms of chlorine residual if the bacteriological quality of the effluent can be positively related to chlorine residual. The following is an example of a performance standard (*37*): "The median coliform MPN, in any one month, shall not exceed 500 per 100 ml., based on not less than 16 composite samples per month, and not more than 10 percent of the samples shall have an MPN in excess of 10,000 per 100 ml. Determinations of the chlorine residual of the effluent should be made hourly and recorded in the permanent plant records."

(2) Total quantity of sewage which can be discharged from any given unit, or from a combination of units, without causing the basic water quality standards to be exceeded.

(3) Amount of shipping in the area and the amount of sewage which can be expected.

Design criteria which may be useful in formulating an opinion on the quantity of sewage which can be discharged into an area without exceeding the desired water quality standards include: Population equivalent (*coliform*) of sewage; predicted survival of coliform in sea water, effectiveness of chlorination, and the total quantity of clean dilution water in an area. Results of many studies on the survival of bacteria in sea water have been summarized in *An Investigation of the Efficacy of Submarine Outfall Disposal of Sewage and Sludge;* Publication No. 14, California State Water Pollution Control Board, 1956.

The mechanical equipment at critical sewage treatment or pumping units should be such that interruptions will be minimized. Wherever possible operations should be automatically recorded on charts. Examples of the requirements which might be imposed, depending upon the importance of the unit in terms of water quality, include:

(1) Ample capacity for storm flows. (Storm water should ordinarily be excluded from the sanitary system.)

(2) Standby equipment to insure that treatment or pumping will not be interrupted because of damage to a single unit or to power failure.

(3) Instrumentation of pumps and equipment to allow the regulatory agency to determine that performance standards have been met. Examples include:

(*a*) Recording scales to indicate rate of chlorine use. Chlorine flow can be integrated with hydraulic flow to establish a ratio.

(*b*) Liquid level recording gages in overflow channels of sewage treatment plants and wet wells of lift stations to indicate when overflow takes place. Charts should be dated and initialed by the operator. Gages should be calibrated so that discharge can be estimated.

(*c*) Automatic devices to warn of failure or malfunctioning at self-operated pumping stations or treatment plants.

(4) The effect of storm sewage can be calculated by multiplying the total estimated flow by the observed coliform content. The result can be expressed in terms of population equivalents (*coliform*).

Design and operation of equipment should be such that closure provisions should not have to be invoked more than once per year under ordinary circumstances.

A closed safety area should be interposed between the *conditionally approved* area and the source of pollution. The size of such area should be based on the total time it would take for the operating agency to detect a failure, notify the State shellfish control agency, and for the latter agency to stop shellfish harvesting. It is recommended that the area be of such size that the flow time through the safety area be at least twice that required for the notification process to become effective. Due consideration should be given to the possibility that closure actions might be necessary on holidays or at night.

The type of marking which will be required for *conditionally approved* areas will vary from State to State depending upon the legal requirements for closing an area.

The length of time a *conditionally approved* area should be closed following a temporary closure will depend upon several factors including the species of shellfish, water temperature, purification rates, presence of silt or other chemicals that might interfere with the physiological activity of the shellfish, and the degree of pollution of the area. (See section D–1 of this manual for additional information on the natural purification of shellfish.)

5. Restricted Areas.—An area may be classified as *restricted* when a sanitary survey indicates a limited degree of pollution which would make it unsafe to harvest the shellfish for direct marketing. Alternatively the States may classify such areas as prohibited. (See section C–6, this manual.) Shellfish from such areas may be marketed after purifying or relaying as provided for in section D.

Satisfactory compliance.—This item will be satisfied when the following water quality criteria are met in areas designated by States as *restricted.*[11] [12]

a. The area is so contaminated with fecal materials that direct consumption of the shellfish might be hazardous, and/or

b. The area is not so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be hazardous, and/or

c. The coliform median MPN of the water does not exceed 700 per 100 ml. and not more than 10 percent of the samples exceed an MPN of 2,300 per 100 ml. in those portions of the areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. (Note: this concentration might be exceeded if less than 800,000 cubic feet of a coliform-free dilution water are available for each population equivalent (*coliform*) of sewage reaching the area.)

d. Shellfish from *restricted* areas are not marketed without controlled purification or relaying.

Public-health explanation.—In many instances it is difficult to draw a clear line of demarcation between polluted and nonpolluted areas. In such instances the State may, at its option, classify areas of intermediate sanitary quality as *restricted* and authorize the use of the shellfish for relaying, or controlled purification.

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[11] It is not mandatory that States use this classification. Areas not meeting the *approved* classification may be closed to all harvesting for direct marketing.

[12] Routine sanitary surveys and reappraisals of *restricted* areas shall be made on the same frequency as for *approved* areas. (See section C–1.)

6. Prohibited Areas.—An area shall be classified *prohibited* if the sanitary survey indicates that dangerous numbers of pathogenic microorganisms might reach an area. The taking of shellfish from such areas for direct marketing shall be prohibited. Relaying or other salvage operations shall be carefully supervised to insure against polluted shellfish entering trade channels. Actual and potential growing areas which have not been subjected to sanitary surveys shall be automatically classified as *prohibited.*

Satisfactory compliance.—This item will be satisfied when:

a. An area is classified as *prohibited* if a sanitary survey indicates either of the following degrees of pollution:

(1) The area is contaminated with radionuclides or industrial wastes that consumption of the shellfish might be hazardous and/or

(2) The median coliform MPN of the water exceeds 700 per 100 ml. or more than 10 percent of the samples have a coliform MPN in excess of 2,300 per 100 ml. (Note: This concentration might be reached if less than 800,000 cubic feet of a coliform-free dilution water are available for each population equivalent (*coliform*) of sewage reaching the area.)

b. No market shellfish are taken from *prohibited* areas except by special permit as described in section D.

c. Coastal areas in which sanitary surveys have not been made shall be automatically classified as *prohibited.*

Public-health explanation.—The positive relationship between enteric disease and the eating of raw or partially cooked shellfish has been outlined in section C–1. Prevention of the interstate transport of shellfish containing sufficient numbers of pathogenic microorganisms to cause disease is a primary objective of the National Program. Therefore, areas containing dangerous concentrations of microorganisms of fecal origin, or areas which may be slightly contaminated with fresh fecal discharges, should not be approved as a source of shellfish for direct marketing.

7. Closure of Areas Due to Shellfish Toxins.—The State shellfish control agency shall regularly collect and assay representative samples of shellfish from growing areas where shellfish toxins are likely to occur. If the paralytic shellfish poison content reaches 80 micrograms per 100 grams of the edible portions of raw shellfish meat, the area shall be closed to the taking of the species of shellfish in which the poison has been found.[13] The harvesting of shellfish from such areas shall be controlled in accord with the recommendations of sections E-1 and E-2 of this manual.

The quarantine shall remain in effect until such time as the State shellfish control agency is convinced the poison content of the shellfish involved is below the quarantine level.[14]

Satisfactory compliance.—This item will be satisfied when—

a. The State shellfish control agency collects and assays representative samples of shellfish for the presence of toxins from each suspected growing area during the harvesting season. (See section B–2 for assay methods.)

b. A quarantine is imposed against the taking of shellfish when the concentration of paralytic shellfish poison equals or exceeds 80 micrograms per 100 grams of the edible portion of raw shellfish.

Public-health explanation.—In some areas paralytic poison is collected temporarily by bivalve shellfish from free-swimming, one-celled marine plants on which these shellfish feed. The plants flourish seasonally when water conditions are favorable.

Cases of paralytic poisoning, including several fatalities, resulting from poisonous shellfish have been reported from both the Atlantic and Pacific coasts. The minimum quantity of poison which will cause intoxication in a susceptible person is not known. Epidemiological investigations of paralytic shellfish poisoning in Canada have indicated 200 to 600 micrograms of poison will produce symptoms in susceptible persons and a death has been attributed to the ingestion of a probable 480 micrograms of poison. Investigations indicate that lesser amounts of the poison have no deleterious effects on humans. Growing areas should be closed at a lower toxicity level to provide an adequate margin of safety since in many instances toxicity levels will change rapidly (*38*) (*39*). It has also been shown that the heat treatment afforded in ordinary canning processes reduces the poison content of raw shellfish considerably.

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[13] This value is based on the results of epidemiological investigations of outbreaks of paralytic shellfish poison in Canada in 1954 and 1957 (*38*) (*39*).

[14] The provisions of this item apply only to shellfish which will be marketed as a fresh or frozen product as properly controlled heat processing will reduce the poison content of the shellfish.

A review of literature and research dealing with the source of the poison, the occurrence and distribution of poisonous shellfish, physiology and toxicology, characteristics of the poison, and prevention and control of poisoning has been prepared (*40*).

In Gulf coast areas, toxicity in shellfish has been associated (*12*) (*76*) with Red Tide outbreaks caused by mass bloomings of the toxic dinoflagellate, *Gymnodinium breve.* Toxic symptons in mice suggest a type of *ciguatera* fish poisoning rather than symptoms of paralytic shellfish poisoning.

Section D

PREPARATION OF SHELLFISH FOR MARKETING

1. Relaying.—State shellfish control agencies may approve the intra- or interstate transplanting of market shellfish from restricted or prohibited areas to approved areas subject to certain limitations. All phases of the operation shall be under the immediate supervision of responsible State(s) shellfish control or patrol agency(s). A memorandum of understanding shall be developed between the agencies responsible for the control of interstate relaying operations. (Shellfish may be transplanted from an *approved* area to another like area at any time without restriction due to sanitary reasons.)

Satisfactory compliance.—This item will be satisfied when—

a. Shellfish are not relaid from *restricted* or *prohibited areas* to *approved areas* without written permission of the State shellfish control agency.

b. All relaying operations are under the *immediate* supervision of the State shellfish control or patrol agency. Supervision shall be such that no polluted shellfish are marketed before the end of the approved relaying period. The supervising officer shall be authorized and equipped to enforce the State regulations on relaying; shall actually supervise the harvesting, transport and relaying of shellfish; and shall patrol the *approved* area during the period that shellfish are undergoing the cleansing process. However, continuous supervision will not be necessary if relaying operations are carried out during a period when shellfish may not be marketed. A continuous record of water temperature, salinity, and any other critical variables must be maintained when it is known that the limiting values may be approached and when the minimum relaying periods are being used.

c. State permission to relay shellfish is given only to responsible persons; responsibility to be determined by the past record of the permit applicant.

d. Relaid shellfish are held in the *approved* area for a period of time sufficient to allow them to cleanse themselves of polluting bacteria. (The time required for purification will be determined by water temperature, salinity, initial bacteriological quality and species of shellfish.)

e. Relaid shellfish are not harvested without written permission from the State shellfish control agency.

f. Areas designated for relaid shellfish are so located and marked that they may be readily identified by the harvesters and so that shellfish in any adjacent *approved* area will not be contaminated. (This requirement applies only to relaying during the harvesting season.)

g. Shellfish are not relayed intra or interstate from restricted or prohibited areas to *approved* areas without written permission of the State(s) shellfish control agency(s). (If shellfish are relayed interstate, a memorandum of agreement shall be devloped outlining the control measures to be used.)

Public-health explanation.—Shellfish transplanted from a polluted to a clean environment will cleanse themselves of the polluting bacteria or viruses. This is a natural phenomenon resulting from the shellfish feeding processes. Bacteria or viruses in the body and shell cavity of the shellfish at the time of transplanting are either used as food or are ejected in feces or pseudofeces.

The length of time required for this cleansing process is influenced by many factors including original level of pollution, water temperature, presence of chemicals inhibitory to physiological activity of the shellfish, salinity, and varying capabilities of the individual animals. Advice on limiting water temperatures, either maxmum or minimum, should be obtained from local marine biologists.

Investigations by marine biologists have confirmed that the psysiological activities of the Eastern oyster (*Crassostrea virginica*) is reduced when the water temperature falls below a certain value. It has been found that the pumping rate of Eastern oysters is reduced at water temperatures below 50° F., and that most animals stop pumping at a water temperature of about 41° F. However, a few oysters show slight activity at temperatures approaching 32° F. (*41*) (*42*). This phenomenon was first noted by shellfish bacteriologists who found that Eastern oysters harvested from polluted areas during cold weather had coliform contents comparable with those of oysters harvested from clean areas during warmer weather (*43*) (*44*) (*45*).

Gibbard *et al.* (*46*) investigating temperature-induced hibernation was unable to demonstrate coliforms in Eastern oysters within a few days after the water temperatures dropped to 32° F. The rapidity with which hibernating oysters become active when the water temperature rises above the threshold value was discussed by Wachter (*47*) in 1925 and was demonstrated by Gibbard *et al.* (*46*). The latter investigator found that contamination accompanying a sudden two degree increase in water temperature from 41° to 43° F. was reflected in the oysters in one day.

Relaying operations must be carefully supervised by an official State agency since the shellfish may contain pathogenic microorganisms. Control must apply to all phases of the operation including initial harvesting, transportation, replanting, purification period, and final harvesting for marketing if the relaying area is adjacent to a restricted area or to an area containing relaid shellfish which have not been released for harvesting.

2. Controlled Purification.—Shellfish from *restricted* or *prohibited* areas may be marketed after effective controlled purification. Purification shall be permitted only under the immediate supervision of the State shellfish control agency. Water used for purification shall be of high bacteriological quality and its physical and chemical properties shall be favorable to maximum physiological activity of the shellfish. Stringent precautions shall be taken by the State shellfish control agency to insure that shellfish harvested from *restricted* or *prohibited* areas are actually submitted to an effective purification process before marketing.

Purification of shellfish from *prohibited* areas shall not be approved by the State unless relaying is not practical for biological reasons, and no public-health hazard will result from the use of such shellfish.

Satisfactory compliance.—This item will be satisfied when:

a. The controlled purification system, including water treatment, has been demonstrated to be consistently effective for the species of shellfish being purified. Purification may be accomplished in either a natural body of water or in tanks. (In determining the effectiveness of the process at least the following factors shall be investigated: Water temperature, silt or turbidity, dissolved oxygen, presence of chemicals, and time required for purification.) The bacteriological quality of the purified shellfish shall be at least equal to shellfish of the same species harvested from local *approved* areas.

b. A purification plant operating procedure is developed and copies are supplied to the Public Health Service.

c. Water used for purification is obtained from an area meeting the physical and bacteriological requirements of an *approved* growing area, or in the case of treated water the bacteriological limits of the Public Health Service Drinking Water Standards (*48*) are met. If water is to be treated, it shall be obtained from an area meeting at least the sanitary requirements for a *restricted* area.

d. Water used for purification has chemical and physical characteristics conducive to maximum physiological activity of the shellfish. (Consideration shall be given to the following: Presence of chemicals, turbidity, temperature, salinity and dissolved oxygen, and to the adequacy of the facilities of the operating agency for measuring these characteristics.)

e. Shellfish are freed of contamination and foreign material adhering to shells before purification.

f. Shellfish are culled before and after purification.

g. Purification plant operation is under the administrative control of the State shellfish control agency. Purification plants may be operated by agencies other than the State; however, insofar as the National Shellfish Sanitation Program is concerned, the State is responsible for satisfactory operation.

h. Laboratory control is maintained over the purification operation. Controls shall include at least the following: Daily or tidal-cycle bacteriological quality of water; final bacteriological quality for each lot of shellfish purified; and, when they are critical factors, hourly or continuous salinity determinations and tidal-cycle turbidity determinations.

i. The plant operator possesses a satisfactory knowledge of the principles of water treatment and bacteriology.

j. Animals, rodents, and unauthorized persons are excluded from the plant.

k. Plant employees fulfill the qualifications for a shucker as described in section B–28, part II of this manual.

l. The State has an effective system for assuring that shellfish harvested from *restricted* areas will be submitted to purification before marketing. Shellfish harvesting from *prohibited* areas for controlled purification shall be under the immediate supervision of the State.

m. Shellfish from *prohibited* areas are not subjected to purification unless the State shellfish control agency can show that relaying or depletion is not biologically feasible; and that no public-health hazard will result from the use of such shellfish.

Public-health explanation.—The ability of shellfish to purify themselves in clean water was discovered early in the 1900's. The biological process is reasonably well understood and is described by Arcisz and Kelly (*26*) as follows:

"Purification is a mechanical process effected by the physiological functioning of the shellfish in clean water. When shellfish are feeding, the gills act as a filter to strain out some of the material that may be brought in by the water which passes through them. If this water contains sewage, some of the microorganisms in it are entrapped in the mucus on the body of the shellfish and transferred to the alimentary tract. Some of these are perhaps utilized as food (*49*) and the others discharged from the body in the form of feces and pseudofeces. When shellfish from polluted water are placed in clean water, the sewage bacteria are eliminated from the shellfish, and, since no more are ingested, purification is accomplished."

The purification process has been investigated extensively in England and to a lesser extent in the United States and Canada (*50*) (*51*) (*52*). The technique is reliable if proper methods are used, and insofar as is known, is applicable to all commercial species of shellfish.

Many of the earlier investigators suggested that purification be accomplished in tanks using water which had been subjected to a treatment process (*52*). The analogy with water treatment was carried to the point of recommending a chlorine residual in the purification tanks. However, fishery biologists have shown that shellfish pumping is decreased or inhibited by even small quantities of chlorine (*53*) (*54*). The inhibitory effect of chlorinated-dechlorinated water on activity of Eastern oysters has been noted by the Public Health Service Shellfish Sanitation Laboratory.

Since purification depends upon the pumping rate of the shellfish, it is important that the water be free of chemicals or physical characteristics which might interfere with this activity. For example, silt or dissolved organic substances may influence the pumping rates of shellfish (*55*) (*56*). The relationship of water temperature to pumping rates has been mentioned previously.

Shellfish purification facilities have generally been considered to include holding tanks and water treatment facilities (*57*) (*58*); however, investigations in Canada and England have demonstrated that purification can be accomplished with relatively simple installations if the operation is supervised properly (*59*) (*50*) (*60*) (*61*). Accordingly, any purification process of *proven* effectiveness will be accepted by the national program.

Administrative control of the purification process is necessary to insure that shellfish are properly washed and culled, are held for the required length of time, and that the purification water supply is properly controlled.

Section E

CONTROL OF HARVESTING FROM CLOSED AREAS

1. Identification of Closed Areas.—Shellfish harvesters shall be notified by direct notice and warning signs of areas closed to harvesting. Closed areas shall be so marked or described that they may be easily recognized by the harvesters. The measures necessary to accomplish delineation and notification will vary with the structure of the local shellfish industry and with the legal requirements of each State.

Satisfactory compliance.—This item will be satisfied when:

a. The boundaries of the closed areas are marked by fixed objects or landmarks in a manner which permits successful prosecution of any violations of the closed areas.

b. Shellfish harvesters are notified of the location of closed areas by publication or direct notification (such as registered mail) and/or warning signs posted at points of access to each closed area. The method of notification and identification should permit the successful prosecution of persons harvesting shellfish from the closed areas. (The limiting of shellfish harvesting permits to specific areas is an alternative to posting or notification. Where such a system is used, posting will be required only for closed areas which contain market shellfish.)

Public-health explanation.—Previous sections of this manual have described the public-health reasons for limiting shellfish harvesting to areas free of contamination and shellfish toxins. Methods have been described for the evaluation and classification of such areas. However, classification is not effective unless the State can prevent illegal harvesting of shellfish for direct marketing from these closed areas.

For the most part, control of illegal harvesting depends upon the police activities as described in section E-2. However, adequate delineation of the closed areas is fundamental to effective patrol.

The type of area identification will be determined by the structure of the local shellfish industry. Posting a warning sign is one method of informing shellfish harvesters that an area is closed to the taking of shellfish for public-health reasons. However, if the local shellfish industry is highly organized, with shellfish being harvested by only a few operators, identification may be accomplished by officially informing the harvesters that certain areas are closed to the taking of shellfish. It is recommended that the advice of the State's legal counsel be obtained to insure that the marking of closed areas and notifications to shellfish harvesters are such that illegal harvesting can be prosecuted successfully.

2. Prevention of Illegal Harvesting of Shellfish From Closed Areas.—Closed growing areas shall be patrolled by a State agency to prevent illegal harvesting. The patrol force shall be so equipped that its officers will be able to apprehend persons taking shellfish from closed areas.

Satisfactory compliance.—This item will be satisfied when—

a. There is no evidence that shellfish are being harvested from closed areas except by special permit as required to meet local conditions.

b. Closed shellfish growing areas are patrolled by representatives of an official agency, due consideration being given to night, weekend and holiday patrols. (States may delegate patrol activities to local organizations; however, responsibility for effective control will remain with the State insofar as the National Program is concerned.

c. Patrol forces are so equipped that persons observed in closed areas may be apprehended.

d. Complete records of patrol activities, including violations and court actions, are maintained in the central office of the State shellfish control or patrol agency. It will be the responsibility of the State to include local patrol activities in these records. (See section A, subsection 2(e) regarding monthly summaries of patrol activities.)

Public-health explanation.—The primary objective of the National Program is to insure that shellfish will be harvested only from areas which are free of dangerous concentrations of pathogenic microorganisms, industrial or radioactive wastes, pesticides or shellfish toxins.

Growing areas may be classified as to their public-health suitability for shellfish harvesting on the basis of information obtained by sanitary and toxicological surveys. However, if local shellfish harvesters are not convinced of the need for restrictions, shellfish may be harvested surreptitiously from the closed areas. Thus, patrol failure may nullify the public-health safeguards resulting from sanitary survey activities.

The fact that law prohibits the removal of shellfish from certain areas will deter most persons from attempting to harvest such shellfish provided they are aware of the law and of the areas which are closed. However, local public opinion may not support the need for such closures. In such cases favorable opinion can probably be developed only through an educational program or a locally demonstrated need such as an epidemic or outbreak of paralytic shellfish poisoning. There is also a minority element not concerned with the welfare of their customers and who, through ignorance or purpose, will attempt to circumvent the harvesting restrictions.

Patrols must, therefore, be directed against three classes of individuals; i.e., those who are ignorant of the law, those who believe the law is unjust or unreasonable, and those who have no regard for the law.

Several mechanisms for improving the effectiveness of patrols include educational programs to acquaint shellfish harvesters with the public-health reasons for the closures, elimination of the "temptation element" by depletion, and relaying or purification. Apprehension, prosecution, and punishment of violators is a final resort.

The type of patrol organization needed for any particular situation cannot be specified and is determined by the nature of areas to be patrolled, means of access, methods of harvesting, and species. Patrol equipment should be such that the officers can apprehend persons harvesting shellfish in a closed area. Necessary equipment might include patrol boats capable of operating in open waters; small, high-speed, readily transportable boats, or patrol automobiles. In many instances, two-way radio will be helpful in coordinating patrol activities. Radar surveillance systems might also be of assistance, particularly during foggy weather or at night.

Organization of the patrol activity must take into consideration the need for night, weekend, holiday, and surprise patrols. Either nuisance or continual patrol may be used depending on the nature of the area to be patrolled and the type of industry.

The adequacy of State laws as a basis for prosecution is an important component of this activity. Shellfish patrol will probably be ineffective if State laws are so written or interpreted that violators cannot be successfully prosecuted, or if penalties are so small that they are economically unimportant. The latter point may be important in an area where local public opinion does not support the need for the restriction.

3. Depletion of Closed Areas.—The State shellfish control or patrol agency shall supervise all depletion operations. All market-size shellfish and as many of the smaller size as can be gathered by reasonable methods shall be removed in the initial depletion operation. Depletion of each area shall be carried out at intervals to prevent the development of market-sized shellfish.

Satisfactory compliance.—This item will be satisfied when—

a. The State shellfish control or patrol agency exercises direct supervision over each depletion project including patrol of the area in which the shellfish are relaid. (See section D–1.)

b. All market shellfish and as many of the smaller size shellfish as can be gathered by reasonable methods are removed in the depletion operation.

c. Similar supervised depletion operations are carried out at intervals to prevent development of market-sized shellfish in quantities which would make commercial harvesting economically practicable in the depleted areas.

Public-health explanation.—Complete removal of shellfish from polluted to clean areas under appropriate precautions is the best safeguard against contaminated shellfish reaching the market. In some cases depletion may be more economical and effective than patrol of closed areas.

Appendix A

BACTERIOLOGICAL CRITERIA FOR SHUCKED OYSTERS AT THE WHOLESALE MARKET LEVEL

The development of satisfactory bacteriological criteria for interstate shipments of oysters as received at the wholesale market level has been under consideration since 1950. At that time the Canadian Department of National Health and Welfare pointed out that most of the U.S.-shucked Eastern oysters sold in Canada had high coliform MPN's, high standard plate counts, or both (*2*). The Canadian experience with market standards for oysters was discussed at the 1956 National Shellfish Sanitation Workshop (*2*) and the Workshop adopted on an interim basis the following bacteriological standard for shucked Eastern oysters at the wholesale market level:

"*Class 1, Acceptable:* Shucked oysters with a Most Probable Number (MPN) of coliform bacteria of not more than 16,000 per 100 ml., and/or a Standard Plate Count of not more than 50,000 per ml.

"*Class 2, Acceptable on Condition:* Shucked oysters with a coliform MPN greater than 16,000 per 100 ml., but less than 160,000 per ml., and/or a Standard Plate Count greater than 50,000 per ml., but less than 1 million per ml. (The oysters will be accepted on the condition that the shellfish sanitation authority in the originating State will make immediate investigation of the producer's plant and operations and will submit a report of such investigations to the control agency in the market area. On the basis of this report the control agency in the market will reject or permit further shipments from the producer in question.)

"*Class 3, Rejectable:* Shucked oysters with a coliform MPN of 160,000 or more per 100 ml., and/or a Standard Plate Count of 1 million or more per ml."

In establishing the above interim standards, the 1956 Workshop recognized the limitations of the coliform group as an index of quality in that it failed to reveal whether the shellfish had been harvested from polluted areas or had been exposed to contamination during handling and processing subsequent to removal from the water. A recommendation was made that investigations be conducted to evaluate the significance of other bacterial indices. The fecal coliform group was suggested as a possible substitute for the coliform indices.

In partial fulfillment of this suggestion, a report on an interstate cooperative study to evaluate bacteriological criteria for market oysters was presented at the 1958 Shellfish Sanitation Workshop (*3*). A feature of this report was the development and evaluation of a method for the estimation of fecal coliform organisms following a procedure originally developed by Hajna and Perry (*77*). Gross increases in coliform organisms were observed during normal acceptable commercial practices. The magnitude of changes in coliform organisms was of the same order as those observed in plate counts. The results clearly demonstrated the inadequacy of the coliform group as an indicator of the sanitary quality of shellfish. It was further concluded that the plate count was of equal significance in revealing chance contamination or violations of acceptable storage time and temperature. On the other hand, the results of the examinations for fecal coliform organisms revealed a much higher degree of stability as the shellfish proceeded through commercial channels and thus suggested the greater suitability of this parameter as an index of sanitary quality at the wholesale market level. After due consideration of the report, the 1958 Workshop changed the interim bacteriological standard for fresh and frozen shucked oysters at the wholesale market level to the following:

Satisfactory.[15] *E. coli* density of not more than 78 MPN per 100 ml. of samples as indicated by production of gas in E. C. liquid broth media nor more than 100,000 total bacteria per ml. on agar at 35° C. will be acceptable without question. An *E. coli* content of 79 to 230 MPN per 100 ml. of sample or a total bacteria count of 100,000 to 500,000 per ml. will be acceptable in occasional samples. If these concentrations are found in two successive samples from the same packer or repacker, the State regulatory authority at the source will be requested to supply information to the receiving State concerning the status of operation of this packer or repacker.

Unsatisfactory.[15] *E. coli* content of more than 230 MPN per 100 ml. of sample or a total bacteria count of more than 500,000 per ml. will constitute an unsatisfactory sample and may be subject to rejection by the State shellfish regulatory authority. Future shipments to receiving markets by the shipper concerned will depend upon satisfactory operational reports by the shellfish regulatory authorities at the point of origin.

In adopting the above standards, the 1958 Workshop recommended that the cooperative studies conducted by city and State laboratories and the Public Health Service be continued.

The 1961 Workshop reviewed still more data collected by the collaborating agencies during the 1958–61 period (*67*) and after considerable deliberation agreed to continued use of the interim bacteriological standards arrived at by the 1958 Workshop.

The 1964 Workhop considered all bacteriological data available up to that time (Nov. 17–19), including data relative to *Crassostrea gigas*, and adopted the following standards on a permanent basis, versus the previous interim basis, as being applicable to all species of fresh and frozen oysters at the wholesale market level, *provided they can be identified as having been produced under the general sanitary controls of the National Shellfish Sanitation Program.*[16]

Satisfactory. Fecal coliform density [17] of not more than 230 MPN per 100 grams and 35° C. plate count [18] of not more than 500,000 per gram will be acceptable without question.

Conditional. Fecal coliform density of more than 230 MPN per 100 grams and/or 35° C. plate count of more than 500,000 per gram will constitute a conditional sample and may be subject to rejection by the State shellfish regulatory authority. If these concentrations are found in two successive samples from the same shipper, the State regulatory authority at the source will be requested to supply information to the receiving State concerning the status of operation of this shipper. Future shipments to receiving markets by the shipper concerned will depend upon satisfactory operational reports by the shellfish regulatory authorities at the point of origin.

In establishing the above bacteriological standards the 1964 Workshop took cognizance of the fact that no known health hazard was involved in consuming oysters meeting the standard; that oysters produced in the Gulf Coast States with warmer growing waters, could meet the standard if harvested, processed, and distributed according to the National Shellfish Sanitation Program requirements, and that the oysters harvested were from "approved" growing areas complying with the standards for growing areas established in part I of the PHS Publication No. 33.

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[15] *E. coli* was defined as coliforms which will produce gas from E. C. medium within 48 hours at 44.5° C. in a water bath will be referred to as fecal coliforms.

[16] The standards are not considered meaningful in the absence of such information.

[17] Fecal coliform organisms are those which, on transfer to E.C. medium from gas positive presumptive broth tubes show production of gas after incubation in a water bath at 44.5° C. ±0.2° C. for 24 hours. Where air incubation is at 45.5° C. ±0.2° C. comparative tests must be made to determine comparable time of incubation.

[18] Plate count is the number of bacteria determined by the "Standard Plate Count: procedure for shellfish described in the APHA Recommended Procedures for the Bacteriological Examination of Sea Water and Shellfish."

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INDEX

Page
Approved areas:
  bacteriological quality, 13
  classification, 12
  definition, 13
  industrial wastes, 13
  radioactive materials, 15
  relationship to sewage treatment, 15
  sanitary survey, 11
Bacteriological:
  content of hibernating shellfish, 21
  control of purification, 22
  die out, 11, 17
  examination of growing water, 11
  frequency of water sampling, 11
  most probable numbers, 3, 11
  procedures, 9
  quality of shucked market oysters, 26, 27
  relationship of sewage treatment to water quality, 16, 17
  shellfish-water relationship, 15
Certificates, shipper, 7
Ciguatera poison, 9, 20
Classification of growing areas, 12
Coliform group, definitions, 3
Conditionally approved areas:
  boundary marketing, 16, 17
  definition, 15
  discussion, 15, 16, 17, 18
  establishment of performance standards, 17
  in harbors, 16
  near resort areas, 15, 16
  performance standards, 16
  records, 16, 17
  relationship to river discharge, 17
  safety zones, 16, 18
  water quality requirements, 15
Controlled purification:
  administrative control, 22, 23
  definition, 3
  discussion, 22, 23
  laboratory control, 22
  use of shellfish from restricted or prohibited areas, 22
  water quality required, 22
Cooperative program:
  application to growing areas, 6
  application to handlers, 6
  application to harvesters, 6
  definition, 3
  history, 1
Closed areas:
  depletion of, 25
  marking of boundaries, 24
  notification to harvesters, 24
  use of shellfish, 24
Definitions, 3
Depletion of closed areas, 25
Die-out of bacteria, 11, 17
Disease from shellfish, 10, 13, 19
Growing areas, definitions, 3
Hibernation of shellfish, 21
Industrial wastes:
  in approved areas, 13
  in prohibited areas, 19
  in restricted areas, 18

Page
Identification of growing areas, 10
Infectious hepatitis from shellfish, 13
Intrastate sale of shellfish, 8
Laboratory:
  bacteriological procedures, 9
  chemical and physical procedures, 9
  control of purification, 22
  toxicological procedures, 9
Laws and regulations:
  classification of growing areas, 5
  control of illegal harvesting, 5
  general requirements, 5
  harvesting permits, 5
  relationship to patrol, 24
Most probable number—see bacteriological.
Paralytic shellfish poison:
  closure of areas, 19
  collection and assay of samples, 19
  discussion, 19
  in approved areas, 13
  laboratory examination for, 9
  quarantine level, 19
Patrol:
  equipment required, 24, 25
  frequency, 25
Need:
  shellfish for purification, 22, 23
  records, 22
  relationship to State laws, 22
  relaying, 21
Prohibited areas:
  bacteriological quality, 19
  depletion of, 25
  establishment of, 19
  identification and marking, 24
  patrol of, 24, 25
  radioactive materials in, 19
  use of shellfish from, 19, 20, 24
Radioactive materials:
  in growing areas, 13, 15
  in shellfish, 15
  maximum permissible concentrations, 15
Records:
  court actions, 5, 24
  operation of conditionally approved areas, 15
  patrol activities, 5, 24
  plant inspection, 6
  purification plant operation, 22, 23
  relaying, 21, 22
  sanitary surveys, 6, 10
Relaying:
  from restricted or prohibited areas, 21
  marking and identification of relaying areas, 21
  permission for, 21
  supervision of, 21
Repackers:
  inspection, 7
  records of inspection, 7
  requirements for certification, 6
  sanitary rating, 6

Page

Restricted areas:
  bacteriological quality of 18
  depletion of 25
  establishment of 18
  fecal contamination of 18
  patrol of 24
  radioactive materials in 18
  use of shellfish from 18, 21, 25
Sanitary surveys:
  content of 10
  definition 3
  frequency required 10, 12
  purpose 11
  records 6, 10
  sewage treatment evaluation 15, 16, 17, 18
Self-purification of shellfish 21
Sewage treatment:
  instrumentation and records 17, 18
  performance standards for 16, 17
  records of 16
  relationship to approved areas 15
Sewage treatment—Continued
  relationship to bacteriological sampling 15
  special equipment requirements 18
  storm sewers 18
Shellfish shipper certificates:
  control 6
  expiration date 7
  requirements for 7
Shellfish shipper list 7
Shell stock shippers:
  inspection 7
  records of inspection 7
  requirements for certification 6
Shucker-packers:
  inspection 7
  records of inspection 7
  requirements for certification 7
  sanitary rating 6, 8
Transplanting 3
Typhoid fever—see Disease.
Wet storage 13

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APPENDIX B

Odor Evaluation Test Procedures and Results

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6
UNITED STATES GOVERNMENT

Memorandum

FEDERAL WATER QUALITY ADMINISTRATION
5555 Ridge Avenue, Cincinnati, Ohio 45213

TO :

DATE: November 20, 1970

FROM :

SUBJECT: ODOR EVALUATION REPORT

Product : Oysters and Water from Galveston Bay

Submitted by : John G. Connor, Division of Field Investigations--Denver Center

Dates Tested : November 16 and 17, 1970

Panel : 4 experienced judges; 2 inexperienced judges; 6 judgments per sample

Samples : Controls (Ref.) and samples 1, 2, 3, 4a, 5, 6, 7

Procedure : The live oysters were thoroughly scrubbed, individually wrapped in aluminum foil, and baked at 450° until the shells opened (approximately 45 minutes). One reference oyster and one sample oyster were submitted to each panelist. The judges were asked to score the degree of odor from each sample on a seven point scale--from 7, no odor, to 1, very extreme odor.* The raw oysters were evaluated by placing the meat from three oysters in screw top jars. The judges were given two jars--one containing a reference and the other containing sample oysters. The odor was scored on the same 1 to 7 point scale.

The threshold odor on the water samples was determined by the method prescribed in the 12th edition of "Standard Methods for the Examination of Waters and Waste Waters."

Results : The results from the oyster odor evaluation were analyzed by the Chi-square test. A linear regression was performed on the results from the water and the oyster samples to determine the relationship between the odor of the Galveston Bay water samples and the odor of the oysters.

---

* Score sheet appended.

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In the raw oyster test, the reference and sample 1 received similar scores as would be expected in that the reference samples were drawn from sample 1. All the remaining samples scored significantly lower (.05) than the reference sample. Samples from stations 2 and 4a were given the lowest rating (very strong odor). The samples from station 2 were characterized by some of the panelists as having a petroleum odor, while the samples from station 4a had a sewage odor. The samples from stations 3, 5, and 6 had strong odors, while the sample from station 7 received a rating almost the same as that given to the reference and the samples from station 1.

The results from the roasted oyster odor test indicate the same pattern of off-odor. The testing of the roasted oysters was limited to stations 3, 5, 7, and a reference from station 1 because of the extreme odors being emitted from the oyster shells.

The results from the water odor tests indicate that the water from station 1 had the lowest threshold odor. The samples from stations 3 and 4a received the highest threshold odor values. The linear regression between the odor evaluations of the raw oysters and the water samples indicates that there is no correlation between the two. Upon examination of the water odor results, it was found that station 2 received a very low threshold odor value. If the results from station 2 are eliminated, a very high correlation (.9) exists between the odor of the water and the odor of the oysters obtained from the same stations in Galveston Bay. The validity of the water sample from station 2 should be investigated as it might have been influenced by abnormal hydrological conditions.

In conclusion, only the oysters from station 1 did not have a strong off-odor. The strong odor of the oysters from stations 2, 3, and 4a would lower their palatability, thus reducing the marketability of these shellfish.

ODOR EVALUATION DATA

Judge	Ref.	1	2	3	4a	5	6	7
				RAW OYSTERS				
1	4.0	5.0	4.0	2.0	4.0	4.0	4.0	5.0
2	4.5	4.5	3.5	1.5	2.0	1.5	2.5	4.0
3	5.0	6.0	4.5	4.5	5.0	4.5	6.0	6.0
4	6.0	6.0	2.0	5.0	2.0	5.0	7.0	4.0
5	4.0	4.0	2.0	4.0	2.0	4.0	2.0	5.0
6	5.0	4.0	2.0	6.0	2.5	5.0	2.5	3.0
Total	28.5	29.5	18.5	23.0	17.5	24.0	24.0	27.0
Average	4.8	4.9	3.1	3.8	2.9	4.0	4.0	4.5
Chi-square		0.65	5.7	3.4	6.3	2.2	3.5	2.2
Probability of the distribution being less than x^2 statistical		0.014	0.67	0.36	0.72	0.18	0.37	0.18
			Petroleum		Sewage			
				ROASTED OYSTERS				
1	6.0	-	-	5.0	-	5.0	-	6.0
2	5.0	-	-	4.0	-	4.0	-	5.0
3	5.0	-	-	5.0	-	3.0	-	5.0
4	4.0	-	-	4.0	-	6.0	-	6.0
5	7.0	-	-	4.0	-	5.0	-	4.0
6	6.0	-	-	1.0	-	4.0	-	6.0
Total	33.0			23.0		27.0		32.0
Average	5.5			3.8		4.5		5.3
Chi-square				5.8		3.4		2.2
Probability of the distribution being less than x^2 statistical				0.67		0.36		0.19
				WATER SAMPLES				
Geometric mean of threshold odor values		5	6	32	32	18	23	11

DIVISION OF FIELD INVESTIGATIONS

CINCINNATI

Name ______________________________

Date ______________________________

Sample ____________________________

Odor

None

Slight

Moderate

Strong

Very Strong

Extremely Strong

Very Extreme

Type of Odor ______________________________

GPO 835-030

MR. GALLAGHER: Mr. Chairman, that concludes my part of the Federal presentation.

CHAIRMAN STEIN: Thank you, Mr. Gallagher, for a very comprehensive report.

I didn't think you would get finished so soon though. I think you presented a real complicated report in record time, and we appreciate that.

Are there any comments or questions at this time?

MR. YANTIS: Mr. Chairman, no real comments, but some of you may have wondered why there have not been some.

The State of Texas will make a presentation tomorrow in which all of our thoughts and data have been put in one presentation, and we think piecemeal comments today would not be in order.

CHAIRMAN STEIN: Thank you.

A question?

MR. VANDERHOOF: Mr. Chairman, I do have some questions for Mr. Gallagher and further presentation, but I would suggest a little later.

CHAIRMAN STEIN: Right.

If it is agreeable, we can have these questions from Mr. Vanderhoof after our luncheon break.

But before we go to lunch, I would like to indicate one thing. I have alluded to this before. The report that you have just heard is a report of our Division of Field Investigation and our field group here. That is just what this report implies, and I for one am making no judgment until the comments from the other parties are in.

This is not to say that the report does not stand on its feet. I think it is an excellent report in that it names names; it names places and it gives numbers. Anyone who feels that the information in the report does not reflect the existing siatuation or that it should be modified will be given an opportunity to comment and make his views known.

With that, we will stand recessed for lunch until 2:00 o'clock.

(Whereupon the conference recessed until 2:00 p.m.)

AFTERNOON SESSION

CHAIRMAN STEIN: Let's reconvene. Mr. Vanderhoof.

MR. VANDERHOOF: Mr. Chairman, I would like to ask Mr. Tom Gallagher a few questions. Tom, I recognize you are without your podium.

MR. GALLAGHER: Yes, sir.

MR. VANDERHOOF: Mr. Gallagher, are there any estimates of the assimilative capacity of the Houston Ship Channel? And can you relate such estimates, if any, to the permitted discharges to water quality standards and to the quality of water in Galveston Bay?

CHAIRMAN STEIN: That is a good question.

MR. GALLAGHER: As I was about to say that is a very comprehensive question.

CHAIRMAN STEIN: One at a time.

Why don't you give him the first question first?

MR. VANDERHOOF: Would you respond to the first part of the question? Are there any estimates of the assimilative capacity of the Houston Ship Channel?

MR. GALLAGHER: Yes, Mr. Vanderhoof, there are some estimates of the assimilative capacity of the

Houston Ship Channel. They are mostly related to dissolved oxygen.

There is an estimate by Dr. Hahn, who is at Texas A & M. Depending on the reaction coefficient used in the Ship Channel, the amount of waste that can be discharged and still meet a 2 ppm dissolved oxygen is somewhere between 10,000 and 40,000 pounds per day.

Dr. Busch of Rice University, in a paper in July of last year, estimated the lower limit of the assimilative capacity at around 35,000 pounds per day. These are 5-day BOD values.

In a paper delivered in Miami, Dr. Hayes and Dr. Gloyan of the University of Texas -- Dr. Hayes, I believe, is now at TRACOR -- estimated that in certain zones about 96 percent reductions of waste were necessary to meet water quality standards.

Those are the major references offhand that I can recall. They all imply a reduction in and above 90 percent of BOD as stated in the Federal report.

MR. VANDERHOOF: Now we have heard you describe that the industrial waste is not of the conventional BOD. Can you relate the other effects to that number?

MR. GALLAGHER: Well, the other parameters don't necessarily affect dissolved oxygen, but they do have acute or chronic effects on marine life.

They may interfere with the ecology of both the Houston Ship Channel and Galveston Bay and may have more long-term, subtle effects than say a straight BOD, which is a measure of a 5-day oxygen demand.

If we assume that we need 90 percent or greater waste abatement from that which is presently being introduced in the Houston Ship Channel -- and this only includes the Houston Ship Channel right now -- then the kinds of treatment that are employed to get that kind of reduction are going to have to be quite extraordinary, because the normal mode of treatment does not remove many complex organic compounds, or toxic material -- heavy metals. And I would say that we are going to have to go to some kind of physical-chemical treatment, such as carbon adsorption or other equally advanced waste treatment measures, in the Houston Ship Channel that will show up to be greater than 90 or 95 percent reduction of

BOD if we are going to get these other compounds as well.

MR. VANDERHOOF: All right.

Now, the second part of my question is: Will you relate the estimate of the permitted discharges?

MR. GALLAGHER: Well, that is a difficult question.

The discharges quoted in the Federal report were based on permits issued in 1968 or earlier. The reason for using this was to get an estimate of the permitted discharge, the aggregate permitted discharge, which we understand has not changed substantially, and also demonstrates the relative magnitude of one waste discharge to say other discharges.

Taking BOD as parameter, I believe it is stated in the report that approximately 180,000 pounds of BOD was permitted to be discharged as a result of those 1968 permits.

Now the various academic and regulatory programs investigations estimate need of a 90 percent or greater reduction, as I reiterated a few minutes ago.

Dr. Hahn in his report estimates around 363,000 pounds per day of BOD. That is cited in the Federal report. That reduction is technical Recommendation No. 11 of the Galveston Bay --

CHAIRMAN STEIN: Mr. Gallagher, let me try it this way.

I think Mr. Vanderhoof raises a question -- I think as I follow your report we have to decide what kind of water quality we are going to have in the stream, and let's take the Houston Ship Channel for one. All right? Now, if you do that, what kind of dissolved oxygen do you think we are going to have?

MR. GALLAGHER: The Texas State Standards specify 1.5 ppm to 2 from the Turning Basin to the San Jacinto Monument.

These are the lower dissolved oxygens in the Ship Channel. To meet that level, and using BOD as your parameter, Dr. Hahn in his report has estimated that about 95 percent reduction of presently introduced waste loads will be necessary.

Dr. Hayes and Dr. Gloyan have estimated 96 percent in certain zone areas. Professor Busch at Rice University implies a 90 to 93 percent reduction, although it is not exactly stated that way, over presently introduced waste discharge. Is this the gist of your question, Mr. Stein?

CHAIRMAN STEIN: Yes, this is the gist. I don't know that they are very far apart.

Presumably it is to go over 90 percent reduction.

MR. GALLAGHER: Yes.

CHAIRMAN STEIN: The question that I have -- and I don't know if we can answer it here, maybe we can -- is whether that 1.5 ppm of dissolved oxygen and 2 ppm dissolved oxygen is what we can live with in the Houston Ship Channel.

As far as I can see, that raises something just barely above Houston's condition, and if you have 1 drop more you have a fettered—up septic mess.

MR. GALLAGHER: Mr. Stein, that is an accurate statement. I would say you have no choice though in this matter right now.

We could shut off 100 percent of the waste discharged to the Houston Ship Channel presently and the organic sludge demand, the inflow from urban runoff, etc., would be enough to keep it down to 1.5 or 2 parts.

It is an accumulated mess of using years and years of discharge that would dictate that.

CHAIRMAN STEIN: The Corps is dredging it out every year. Suppose they dredged it out a few more times and nothing else is put in?

MR. GALLAGHER: There have been estimates there are 2 feet of organic waste on the bottom.

That means the Corps would have to dredge the channel from 22 to 44 feet and at least 2 feet of the sludge to get it out.

CHAIRMAN STEIN: Mr. Gallagher, it has always been my experience when we stop putting materials in that created sludge, rivers recovered, or channels recovered faster than the estimates of the scientists. I recognize that you are being conservative.

MR. GALLAGHER: Yes, sir.

CHAIRMAN STEIN: But the first question I am asking is that if we are going to get a reasonable amount of water use in the Houston and Galveston Bay area, how are we going to peg our requirements in the Ship Channel?

Are we going to put it at 1.5 and 2 ppm of oxygen or are you going to peg it higher?

MR. GALLAGHER: If you peg it higher, Mr. Stein, you will have to have removal of 97, 98 or 99 percent, assuming there is no bottom sludge deposits.

If you wish 1.5 to 2 ppm of dissolved oxygen in the Houston Ship Channel, the reduction in level will be 90 to 95 percent based on BOD alone.

CHAIRMAN STEIN: In the Potomac, we asked for a 98 percent reduction in BOD, in order to keep the Potomac in reasonably good shape. You are suggesting that we set some kind of a lower requirement here?

I recognize those are municipal wastes. To attempt to get that kind of reduction in industrial wastes may be a little more difficult.

MR. GALLAGHER: Exactly.

My response is, Mr. Stein, if you wish to live with a 4 ppm DO or higher, which is usually acceptable for water use, recreation, fishing, etc., you are going to have to talk about between 98 and possibly 100 percent reduction of waste in the Houston Ship Channel, plus flow augmentation and instream aeration. The situation is that bad.

MR. VANDERHOOF: Mr. Gallagher, you have described in terms of reduction -- percent reduction. Is there not some absolute numbers that you can describe to compare it with the permitted loads?

MR. GALLAGHER: That is how I came to those percent reductions. Again, in Dr. Hahn's report I believe it ranges from 10,000 to 40,000 pounds per day.

Dr. Busch represents 35,000 pounds per day.

Dr. O'Connell at the National College has estimated the Ship Channel can maintain a 2 mg/l minimum dissolved oxygen if the waste discharge does not exceed 15 ppm BOD.

CHAIRMAN STEIN: I understand what you are saying. Let me try to understand this.

Again, I just say this for the purpose of the record. You have had considerable experience in the New York Metropolitan Area, haven't you?

MR. GALLAGHER: Yes, sir.

CHAIRMAN STEIN: And working on Arthur Kill (the body of water between Staten Island and New Jersey) which has some kind of remote resemblance to the problems we have here, we finally agreed hopefully on a 3 ppm dissolved oxygen level in the Arthur Kill.

Now, as I understand it, you are suggesting that we have an objective about 1/3 lower than that here?

MR. GALLAGHER: No, Mr. Stein, I am not suggesting that.

I am stating that to meet the standards which have been set by the Texas Water Quality Board in compliance with the 1965 Water Quality Act, i.e., a DO of 1.5 and 2 ppm, we need 95 percent reduction; I think it is desirable to have higher than that.

CHAIRMAN STEIN: Such as what?

MR. GALLAGHER: As high as we can get. I think we should get the most.

CHAIRMAN STEIN: Let me pursue that.

The reason I raise this is because if you go to 1.5 or 2, we know we are not going to maintain that 365 days a year.

MR. GALLAGHER: That is right.

CHAIRMAN STEIN: Seven days a week, 24 hours a day. And we are at such a critical point if we drop below that, we have some very, very, very bad conditions.

If you go up even to 3 you have some margin of safety.

MR. GALLAGHER: Yes, sir.

CHAIRMAN STEIN: Now, let's make the assumption that we are asking for 3.

What kind of reductions will we have to have in the waste in the industry?

MR. GALLAGHER: In excess of 95 percent of BOD.

CHAIRMAN STEIN: Of what? Will it be between 95 and 98?

MR. GALLAGHER: I would guess so, yes, sir.

CHAIRMAN STEIN: Not above 98?

MR. GALLAGHER: I am not sure of that. It might very well be.

CHAIRMAN STEIN: Now, we have required 98 percent BOD reduction in other places, and I think we have to take this into account. But I think we have to keep both of these things in mind.

What I am suggesting is that if you go down to 2 ppm dissolved oxygen, 1.5 parts in the Turning Basin, we have practically pegged the Houston Ship Channel for the lowest quality of water for any similar body of water we have anywhere in the United States. I am just questioning whether that is the thing we want to aim for.

MR. GALLAGHER: I agree, Mr. Stein.

I think if you are aiming for 3 ppm or higher, a requirement of 98 percent reduction in BOD, is a conservative estimate. It will have to be.

CHAIRMAN STEIN: Do you think it is achievable?

MR. GALLAGHER: It can be achieved, but it will not be achieved with the biological treatment methods and ordinary treatment methods.

CHAIRMAN STEIN: I recognize that.

MR. GALLAGHER: Yes, it is achievable.

CHAIRMAN STEIN: All right.

Mr. Vanderhoof?

MR. VANDERHOOF: One more question, Mr. Gallagher.

Can you relate the Houston Ship Channel water to the Galveston Bay water quality?

MR. GALLAGHER: I think we substantially did that in the Federal presentation this morning.

Indications from data, again collected by the Texas Water Quality Board in February 1969 grab samples, showed there was a large quantity of heavy metals.

Data collected in 1970 and data collected from receiving waters in 1969 indicated that concentrations of heavy metals in these receiving waters, both in the Houston Ship Channel and Galveston Bay, were many, many times greater than backgrounds. In some cases, thousands of times greater than backgrounds.

This demonstrates the cause and effect relationship. We have shown hydrocarbon residues are present in oysters taken from Galveston Bay, and, in fact, a persistent condition of water-oil pollution exists in the Houston Ship Channel and many areas of Galveston Bay.

These residues are not the product of the oysters themselves, the biological function of the oysters themselves. They are artificially introduced.

I think this again is a cause and effect mechanism.

We do know that many of the characteristic petrochemical wastes are complex organic compounds, refractory organics, the kind of materials that do not break down very quickly.

Because of physical flushing of the Houston Ship Channel toward Galveston Bay it is inevitable these kinds of compounds are going to eventually be discharged into Galveston Bay and affect the marine life in Galveston Bay. The ecological studies that were presented by Copeland and Floyd demonstrate there is a very substantial effect on the marine life of Galveston Bay.

MR. VANDERHOOF: All right.

MR. GALLAGHER: Is this sufficient?

MR. VANDERHOOF: This, of course, does raise one more question. Can you expand on your previous comments on oil and hydrocarbons in the flesh of the oysters? For instance, how new is this technique? What further studies have you done? What is your general opinion on this subject?

MR. GALLAGHER: The technique is relatively new. It was developed at Woods Hole Oceanographic Institute and modified by our chemists in Cincinnati and Denver and has been used extensively in further surveying the Galveston Bay area.

At the time this report was prepared, we had only the initial surveying done in November 1970.

Since then, we collected samples in January 1971 and April 1971.

This analysis requires about 6 weeks to 2 months for evaluation and verification.

The data collected in January 1971 at a great number of stations -- I believe 5 or 6 in the approved areas -- demonstrated the same discharge of oil and hydrocarbon concentrations. In fact, one value is 40 ppm which is higher than in the Federal report.

This is from the approved area. The concentrations data for April 1971, which we only received 3 days ago from Woods Hole, indicate again the same waste contamination of the oysters in the bay with oil and hydrocarbons. Furthermore, the Woods Hole Institute did a gas chromatograph spectometer analysis to determine just what specific compounds are contained in the oil and hydrocarbon residues, and they came up with compounds which are directly attributable to refinery or petroleum discharges. I can get the reference and name those compounds if you wish.

CHAIRMAN STEIN: It is not necessary.

MR. GALLAGHER: We will make them available for the record if so desired.

MR. VANDERHOOF: I don't believe so.

MR. GALLAGHER: Does this answer your question, Mr. Vanderhoof?

MR. VANDERHOOF: Yes, Mr. Gallagher.

With respect to the Houston Lighting & Power Company you have made recommendations as to acceptable temperature increases and recycling of the cooling water. Now is this, in fact, a viable technical alternative?

Are there other alternatives?

MR. GALLAGHER: Yes, sir, I believe it is.

Recycling and recirculation of cooling water, effluents of cooling water, is not an unusual request to make, particularly in the western part of the United States where water is scarce.

In this particular case, I don't believe it is a question of salt versus freshwater, because there is a source of freshwater available. This would solve the problem with respect to temperature increase in Trinity Bay. Also with the polluted water for cooling purposes.

It would really make academic the point of requiring certain maximum temperature increases in the Trinity Bay, because there would be a very minimal amount of blowdown to Trinity Bay which probably would not have very much of an effect at all.

If you wish to discuss these things in more detail, Dr. Clark Allen of the EPA is here. He has made an evaluation of some of these alternatives if more detail is required.

VOICE: Dr. Allen has an emergency phone call.

MR. GALLAGHER: Dr. Allen isn't available at the present time.

MR. VANDERHOOF: Well, until Dr. Allen comes here would you care to make any comments upon Federal installations?

MR. GALLAGHER: I personally would not. There is a Regional Federal Facilities officer here, Mr. Jerry Thornhill, if he would care to.

CHAIRMAN STEIN: Why don't we wait until he makes his presentation?

One of the things I noted in your report was high coliform counts.

I assume to the best of your knowledge and belief, there is not year-round chlorination in all these sources?

MR. GALLAGHER: That is right, Mr. Stein. There is not year-round chlorination at the Sims Plant or the Northside Sewer Treatment Plant. As of April of this year, neither of these plants, which were discharging a total of about 105 MGD to Galveston Bay was chlorinating.

CHAIRMAN STEIN: Your recommendation is

you have year-round chlorination for all these sources?

MR. GALLAGHER: Yes, sir.

CHAIRMAN STEIN: I would like to make one more point, because I think this is one of the essential points we are talking about in this high degree of treatment. I would like for you to listen to this additional point rather closely.

What we are talking about in terms of getting these high-degree reductions is going to be something other than a biological process.

Now there are several factors in the biological processes that we always recognize. All of the people in the field have worked on it. That is in the biological process it is very difficult to produce the same results day in and day out throughout the year. It is just like any of the women in the audience making a recipe -- depending on what the ingredients are and the products, it varies all the time.

If you are dealing with a living organism your dish may vary.

In the same way, if you try a biological reduction of waste, because of temperature, materials coming in, or unknown factors, the process fluctuates.

Now if we are dealing with critical oxygen levels like 1.5 or 2, which are on the brink of either keeping something above a nuisance condition or getting below, if it doesn't work, you are going to drop below.

What Mr. Gallagher is suggesting is that we go beyond the biological process to perhaps an additional mechanical or chemical process, and these can be controlled more accurately than a biological process. There is this difference in them.

In the biological process, generally in waste treatment, the bugs are free and that gives you one leg up. That brings you up to a point where you can have that reliability.

If you go to a chemical or mechanical process, the materials that you use are expensive and you always have to apply them, and the price of treatment goes way, way, way up in what we are going to achieve. I think this may be the crux of what we are getting at here, because there are several ways of looking at this.

One way of looking at this is that if we are going to get a 90 percent BOD reduction, we are going to pay a certain amount. To get another 8 percent may double or triple the cost. That is one way of looking at it.

Another way of looking at it is thus. If you had a 90 percent BOD reduction and you go up to 98 percent, the 10 percent of the total pollutant going into the stream is being reduced by 80 percent.

Now I think these are the hard issues that we have been trying to deal with. Everyone here is going to have to put his mind on them in order to make a judgment on how to proceed.

Again, before Dr. Allen comes in, I still would like your last judgment on this point. What kind of situation do you think we are going to be in if we set a goal of getting the Houston Ship Channel to take dissolved oxygen to 1.5 or 2 ppm of dissolved oxygen? What kind of water are we going to have and what will happen if we have a slip?

MR. GALLAGHER: We will have water that will be less than that standard a significant percentage of the time due to urban runoff inflows, due to sludge deposits, etc.

If you raise the standards higher, you are talking about the waste treatment measures which we have just expounded on. I would like to expand upon that even further, Mr. Stein.

CHAIRMAN STEIN: All right.

MR. GALLAGHER: Normal biological treatments -- we can only get at best 98 percent reduction of BOD, and not even that all year round -- do not remove some of the other compounds that we are concerned about. They don't remove refractory organics, which are sematic of petrochemical wastes, or heavy metals which are being discharged into the Houston Ship Channel.

These can be removed by means of a physical-chemical process, carbon adsorption or lime filtration or a combination of both.

Not only can we get the oxygen we want from a 98 percent or greater reduction in BOD, but reduction of some of the toxins and compounds which are having deleterious effects in Galveston Bay as well as the Ship Channel. I think it is an absolute necessity that we go to the other kinds of processes.

CHAIRMAN STEIN: I have two questions.

1) Suppose we drop below that 1.5 and 2 ppm for dissolved oxygen as you indicate we might. If we go to biological processes for runoff, will we have lessened prevalence of the condition?

MR. GALLAGHER: Yes.

CHAIRMAN STEIN: If as you say we have to take out other materials and in doing this we have to go to a physical-chemical method of reduction, what kind of dissolved oxygen do you think we can shoot for in the Houston Ship Channel?

MR. GALLAGHER: I think, Mr. Stein, as a first cut, we should aim at 3 ppm of dissolved oxygen or greater from the Turning Basin to the San Jacinto Monument.

CHAIRMAN STEIN: Thank you.

MR. GALLAGHER: Would you still like to hear from Dr. Allen?

CHAIRMAN STEIN: Yes. Dr. Allen?

DR. CLARK ALLEN
REGION VI
ENVIORNMENTAL PROTECTION AGENCY
DALLAS, TEXAS

DR. ALLEN: Mr. Chairman, I am sorry for the delay, but I did have an emergency call.

For the record, I am Dr. Clark Allen with the EPA Regional Office in Dallas.

May I have a redress of the question, please?

MR. VANDERHOOF: Yes.

In the report we have stated that Houston Lighting & Power Company, to provide an acceptable temperature, should recycle or do something else with the heated waters. Would you describe some of the alternatives available?

DR. ALLEN: Yes.

With Units 3, 4, 5 and 6, which are not yet under construction and are still in the planning stages, there appear to be two feasible alternatives to the cooling ponds.

One alternative would be use of forced-draft, freshwater cooling towers. In initial talks with the Industrial Water Authority they indicated the freshwater is available. This is still being pursued.

The second alternative, in place of freshwater cooling towers at this site, would be an alternate site location for the future units.

Discussions with the Brazos River Authority and the Corps of Engineers confirm there is an abundant supply of water on the Brazos River for thermal electric units.

Either of these methods appear to be quite feasible at this time.

MR. VANDERHOOF: Thank you.

DR. ALLEN: Yes, sir.

CHAIRMAN STEIN: Mr. Vanderhoof, do you have any others?

MR. VANDERHOOF: Yes, I do, Mr. Chairman.

Mr. Thornhill will be able to discuss the Federal installations in this area.

MR. JERRY THORNHILL
REGION VI
ENVIRONMENTAL PROTECTION AGENCY
DALLAS, TEXAS

MR. THORNHILL: I am Jerry Thornhill from the Region VI EPA office in Dallas.

I will give you a brief statement on the status of the treatment in Federal installations in the conference area.

We have three major Federal installations -- two in the Clear Creek Basin and one in Galveston.

NASA, the Manned Spacecraft Center, is in the Clear Creek Basin and presently has secondary treatment. It has both domestic and industrial wastes and the industrial wastes are segregated.

CHAIRMAN STEIN: Before you go on, secondary treatment covers a multitude of sins. What BOD reduction is that?

MR. THORNHILL: Well, for example, let me give you some information on the test average for April on the BOD loading that they had.

11.5 mg/l was the quality of their effluents for the month of April. The DO was 10.5, pH 5.6, chlorine residual, 1.1.

I don't know what the percent reduction is in their plant. I don't have that information with me, but this is the average for the month of April.

CHAIRMAN STEIN: Can you estimate a reduction?

MR. THORNHILL: Well, it has to be greater than 85 percent, I'd say. I do not know. They have a very good operating plant.

CHAIRMAN STEIN: Having year-round chlorination?

MR. THORNHILL: Yes.

CHAIRMAN STEIN: Well, if we dovetail what you say to what Mr. Gallagher said just preceding you and we are going for a 98 percent reduction, you would say they are not quite getting 98, wouldn't you?

MR. THORNHILL: I wouldn't think so, no.

CHAIRMAN STEIN: You wouldn't?

They might be closer to 85 than 95?

MR. THORNHILL: Yes.

CHAIRMAN STEIN: All right.

MR. THORNHILL: Well, the important point for NASA, however, is not what they are doing now but what they plan to do. Being in the Clear Creek Basin they have agreed by letter to go to tertiary treatment.

Well, they have given two plans -- two alternative plans.

Plan A would provide tertiary treatment that would meet the requirements of the Texas Water Quality 69-9A Law.

Also this would meet the additional

requirement of the EPA for BOD and suspended solids of 5-5.

Their plan B would be to connect to a regional treatment facility, which is being discussed by the Clear Lake City Water Authority. This would also meet with the requirements of the Texas Water Quality Board orders and would probably be our recommended method for treatment for this particular facility. Both of these plans have been discussed with the Texas Water Quality Board and they have reviewed them or are in the process of reviewing them at this time.

The other facility in Clear Creek Basin is Ellington Air Force Base.

They also have an existing secondary treatment plant, and I do not know their percent removal either. But their average for May, for example, BOD was 5 mg/l. Total suspended solids was 5 mg/l.

CHAIRMAN STEIN: We don't know what quantities they are putting out. It would be helpful if you could speak in the same terms that Mr. Gallagher spoke.

MR. THORNHILL: Well, unfortunately, the

information that was taken from our files did not include the flow, and this was discovered after I was in Houston, and I haven't gotten that information. It can be provided to the reporter, however.

MR. VANDERHOOF: Did I understand you just described the effluents of Ellington as 5-5?

MR. THORNHILL: Five to 5 for the month. This is an average for the month of May.

MR. VANDERHOOF: Is that not a very high degree of treatment?

MR. THORNHILL: Yes.

They have a very efficiently operating secondary treatment plant. But again in this particular instance Ellington is going to tertiary treatment.

CHAIRMAN STEIN: Are they providing year-round chlorination now?

MR. THORNHILL: Yes. Their chlorine residual was 2.0 mg/l average. Both facilities have chlorination.

The third facility, major facility, is in Galveston -- the Coast Guard Station. They have a new secondary treatment plant that has just been put on stream not too many months ago. It is an activated sludge process. It also has disinfection. The other facilities in the area are minor, and most of them connect to the existing municipal treatment facilities.

CHAIRMAN STEIN: Would it be possible for you to give us the load reduction in pounds per day for BOD for all the Federal installations?

MR. THORNHILL: Yes.

I will have that information this afternoon to enter into the record.

CHAIRMAN STEIN: Thank you.

MR. VANDERHOOF: Mr. Thornhill, have all the Federal facilities agreed to the 1965 effluent standards?

MR. THORNHILL: Yes. We notified them and they have indicated their agreement to go to this treatment.

MR. VANDERHOOF: Thank you.

CHAIRMAN STEIN: That is all.

MR. THORNHILL: All right.

MR. VANDERHOOF: The next gentleman will describe the area of the other treatments.

Mr. Kirkpatrick?

MR. KENNETH KIRKPATRICK

REGION VI

ENVIRONMENTAL PROTECTION AGENCY

DALLAS, TEXAS

MR. KIRKPATRICK: Mr. Chairman, conferees, my name is Ken Kirkpatrick. I am from the Dallas EPA Regional Office. I will make a few comments with regard to planning in the Galveston Bay area. I think one of the major problems to effective water quality management planning in the area is the overlapping jurisdictional responsibility of State and local government agencies, local planning agencies, and river basin authorities.

There are at least seven principal planning and regulatory agencies, and I would like to briefly name them. The Texas Water Quality Board, Houston-Galveston Area Council of Government, San Jacinto River Authority, Brazos River Authority, Trinity River Authority, city of Houston, and the Gulf Coast Waste Disposal Authority.

There are those seven major agencies and in addition numerous other sports and smaller groups. Let me just spell these out: universities, the Corps

K. Kirkpatrick

of Engineers -- not necessarily small -- EPA, cities, water districts, U. S. Geological Survey, State agencies and consultants for industry, etc. They are actively engaged in some type of water quality management planning for this area. There is a need to consolidate and interrelate this area while planning efforts to the fullest extent possible.

I think another major problem defective to planning, as well as water quality management itself, is the lack of State laws and regulations to prohibit a widely extensive proliferation of small water districts and the construction of separate waste treatment facilities.

Tighter controls related to land use management:

Issuance of waste discharge permits and adherence to regional concepts must be exercised if an effective plan for treatment and implementation of a water quality management program is to become a reality.

It is fully recognized there is a need to facilitate construction of waste facilities in the Galveston Bay area.

To facilitate this construction, there is an urgent need for State-certified interim planning for the Region, directed toward obtaining full compliance with established water quality standards.

The rules and regulations, 18-C of 601, governing the development of this plan were published in the Federal Register in July 2, 1970, as guidelines to implement the regulations and has subsequently been developed and distributed to virtually all States and local planning agencies.

To date we in Dallas have not received the interim plan for this area or a portion of the area.

As a result, all construction grant applications for projects in this area received after December 31, 1970, cannot be processed until a certified plan has been submitted.

This effort should be given high priority, in our opinion.

I think Mr. Jones is getting information on construction grants, or has it available.

CHAIRMAN STEIN: Right. Thank you.

MR. VANDERHOOF: The next speaker will

describe the status of construction in this particular area.

Mr. Ancil Jones.

MR. ANCIL JONES
REGION VI
ENVIRONMENTAL PROTECTION AGENCY
DALLAS, TEXAS

MR. JONES: Mr. Chairman, conferees, ladies and gentlemen. Briefly, let me give you a historical background concerning this area in the way of grants and projects.

Since 1956, we have been involved under various agency names in 58 projects. These projects have generated grants in the amount of some $13,490,000 odd dollars. Of this $42,786,000 is the total eligible construction cost since 1960. Those are the figures as of this date, according to our records.

I want to emphasize the need for planning. Right now we have 9 applications in our office. Seven of these were begun or have been completed prior to receipt of the application in our office, and these 7 have to comply with the interim basin plans Mr. Kirkpatrick just spoke of.

It might be difficult to make a facility that has been built or already in place to conform to interim basin planning, especially when the interim basin planning has not been approved.

I would like to mention that we have 9 other applications in our office. The total estimated construction cost for these are some $6,564,000 of which a possible $3,610,000 grant could be given, based upon a 55 percent participation from the Federal Government if all other program requirements are met.

Now the 7 applications that we have in our office where construction has begun or has been completed, putting that with the 9 I just mentioned that we have in our office now that we have yet to go under construction, those add up to some $8 million with some $4,700,000 for grant assistance.

Let me say one thing especially in the area of industrial waste treatment. There is a Regulation, 601.34, that governs industrial waste treatment as far as municipalities are concerned. On the industrial waste side when the municipality has an industrial waste, we have to have assurance that the cost of that industrial waste treatment is recovered, plus a cost for operation and maintenance. In some cases, we require pretreatment to protect the domestic facility which we are designing it for, and this pretreatment cost is not to be considered or not eligible under the PR 664.

Thank you.

MR. VANDERHOOF: Thank you.

CHAIRMAN STEIN: Just one moment.

If I understand you, do you mean to say that we have grant applications in the office for which applicants have applied and these have run into how many millions of dollars?

MR. JONES: From this area here, sir?

CHAIRMAN STEIN: Yes, the conference area.

MR. JONES: Of the 18 applications I am referring to there are some $8 million.

CHAIRMAN STEIN: That is in Federal funds?

MR. JONES: That is the total eligible costs.

CHAIRMAN STEIN: That is the total eligible costs. In other words, there are $8 million worth of treatment works which have been applied for, which you haven't been able to process because we don't have the reports that we think we must have?

MR. JONES: Yes, sir.

CHAIRMAN STEIN: That is the only reason we are not processing them?

MR. JONES: We are processing them right now.

CHAIRMAN STEIN: But we can't approve them?

MR. JONES: Yes, sir.

CHAIRMAN STEIN: Now, where does that report have to come from? In dealing with a situation like that, if we have $8 million worth of projects ready to go and the applicants have applied for the money, it seems to me that people are going to think there is an awful bureaucratic snarl if the reason they can't go is because we don't have a report or someone hasn't filed a report. Can we get to the bottom of this?

MR. JONES: Yes, sir.

CHAIRMAN STEIN: Let's hear what it is all about.

MR. JONES: No. 1 is we must do some thinking about the project in the planning stage -- must have adequate engineering reports to adequately cover it that set forth the waste to be treated and the design criteria that are being applied to accomplishing the desired effect. Then other program requirements --

CHAIRMAN STEIN: Just one moment. Do you feel you don't have these reports now?

MR. JONES: Some of these do have interim basin planning. That is one thing, that 7 of these 9 applications that have begun construction or have been completed, the 7 we don't have it on and can't make it until they are approved.

CHAIRMAN STEIN: Whom do you get it from?

MR. JONES: The Texas Water Quality Board.

CHAIRMAN STEIN: They have not submitted them to you?

MR. JONES: Yes, sir.

CHAIRMAN STEIN: Have you asked them?

MR. JONES: Yes, sir.

CHAIRMAN STEIN: What did they tell you?

MR. JONES: They are working on them.

CHAIRMAN STEIN: I guess we will hear from the Texas Water Quality Board tomorrow. (Laughter.)

MR. VANDERHOOF: I would like to hear from our Director, Office of Contracts and Grants for Research, Development and Demonstration, Mr. George Putnicki, on the availability of technology.

MR. GEORGE PUTNICKI, DIRECTOR
OFFICE OF CONTRACTS AND GRANTS FOR
RESEARCH DEVELOPMENT AND DEMONSTRATION
REGION VI
ENVIRONMENTAL PROTECTION AGENCY
DALLAS, TEXAS

MR. PUTNICKI: Mr. Stein, conferees, ladies and gentlemen. For the record my name is George J. Putnicki. I am the Director of the Office of Contracts and Grants for Research, Development and Demonstration, Environmental Protection Agency, Region VI, Dallas, Texas.

In my statement to the conference today, I

G. Putnicki

would like to report on a municipality in the State of Texas that is producing an extremely high quality of effluent without creating a financial burden for the city. This municipality is the city of Richardson, Texas -- a progressive city of 50,000 people just north of Dallas, Texas.

The city of Richardson's wastewater treatment plant is a conventional, biological trickling filter type of plant with a capacity of treating 1.6 MGD of wastewater. A mechanical bar screen precedes a wet well serving 4 raw sewage pumps which lift the water into a flow splitter box. Proportional weirs there divide flow between 3 clarifier-digesters. Primary effluent is combined in a splitter box, then divided and sent to 2 standard rate rock filters. Filter effluent is combined and carried to the final clarifier. Chlorination and settling are simultaneous in that clarifier. A mixture of final sludge and recirculation are returned to the head of the plant; the amount of recirculation is regulated by a level control system in the raw sewage wet well.

Sludge is digested in the lower compartment of each primary clarifier-digester. No heat is provided (gas is wasted through a waste gas burner) and mixing consists of gentle stirring by a 3 rph mechanism revolving on the same shaft as the clarifier rakes above.

Sludge is dried on sand beds. Filtrate collected in the underdrains goes back to the head of the plant. Digester supernatant is drawn and batch treated before return to the head of the plant. Three 500 gallon fill-and-draw tanks receive raw supernatant; 250 mg/l of alum is added, then 20 minutes of air agitation yield a finished liquor which separates into sludge (which goes onto drying beds) and treated supernatant with strength comparable to conventional primary effluent (50 mg/l).

In June 1969 a Federal grant in the amount of $200,000 was made to the city of Richardson for the purpose of demonstrating how a conventional biological trickling filter plant can be modified to permit chemical precipitation of phosphorus and other substances. In this project chemical treatment was intended as an adjunct to a typical conventional treatment facility. Furthermore, it was intended that required modifications be as simple as possible and that the existing facilities be fully utilized.

The two chemicals selected were aluminum in the form of liquid alum and iron in the form of liquid ferric chloride. These chemicals are similar enough in character to permit use of common storage and feeding facilities.

The plant modification consists of fiber glass chemical storage facilities, chemical feed pumps and controls and flash mixing apparatus. The capital improvement cost for modifying this facility was $53,000. This cost included some modifications and analytic equipment required for the research aspects of this project and would not necessarily be needed for the proper operation and maintenance of the facility.

The modifications made it possible to feed chemicals either at the head of the plant in advance of the pump station or at a splitter box located between the trickling filters and the final clarifier. Good results were obtained when 20 percent of the chemical was fed at the head of the plant and 80 percent fed in advance of the final clarifier and when 5 different feed rates were used to accommodate the diurnal fluctuations in both quality and quantity of waste.

Submitted for the record are the operating results obtained at the Richardson Wastewater Treatment Plant during the month of May 1971.

CHAIRMAN STEIN: Without objection, these will be entered in the record.

Let me see how long those are.

	INFLUENT Ave/Max/Min	EFFLUENT Ave/Max/Min	MONTHLY AVERAGE % REDUCTION
FLOW (mgd)	1.4/1.9/1.3		
BOD_5 (mg/l)	183/240/142	11/16/7	94.5
DO (mg/l)	.5/.7/.2	6.7/7.0/6.2	92.5 Increase
SUSPENDED SOLIDS (mg/l)	196/374/110	8/15/3	95.9
TOTAL NITROGEN (mg/l)	26.6/31.9/19.5	12.7/17.0/9.2	52.3
PHOSPHORUS (mg/l)	12.2/16.1/8.2	.7/1.5/.3	94.3
COD (mg/l)	397/528/269	37/67/20	90.7
IRON & ALUMINUM (mg/l)	.7/1.8/.3	1.0/2.0/.4	98.6
TURBIDITY (JTU)	162/196/98	9/14/5	94.4
FECAL COLIFORMS (No./ml)	99000/190000/19500	770/2650/1	99.2

G. Putnicki

Upon completion of this research project, the city of Richardson proposed to continue chemical treatment at this facility.

Incidentally, the wastewater stays in the city of Richardson no more than 20 hours before it is discharged into the city of Dallas where it is used by the city of Dallas -- excuse me -- by Reliance Cemetery and by a country club and goes into a recreational lake where many of us like to boat.

The original wastewater treatment facility was built in 1953 at a total cost of $75,000, exclusive of land. In 1961 treatment facilities were enlarged to the present arrangements; the total cost of those improvements was $250,000, excepting land.

A new laboratory building was added in 1969. This facility is considered an integral part of the treatment system, but perhaps 1/3 of its cost went to extra space for the demonstration project. The building was built at a total cost of $33,000.

A breakdown of the cost of modification to the treatment plant follows:

G. Putnicki

Materials	$35,000
Labor	7,000
Supervision	3,500
Design & Misc.	7,500
	$53,000

Operating costs for chemical coagulation consist almost entirely of chemical costs alone. Additional power might cost $200 or $300 per year. The existing operating staff can run the equipment. Control testing might require an additional analyst in the laboratory, but insufficient experience is available to verify this. Liquid alum costs 33 cents per pound of aluminum, delivered to Richardson. Making some broad assumptions regarding demand, alum costs might run 4 to 6 cents per 1,000 gallons of water.

I would like to briefly mention another project that we have in the specific area of discussion today.

A grant was made to Harris County Water Control and Improvement District No. 50, El Lago, Texas, which will demonstrate a modification of an existing plant for the removal of not only phosphorus but also nitrogen.

This grant was just very recently made, and I have nothing to report on the results. So I would like to mention that in my engineering opinion, we can get the BOD down to the 95 percent range quite readily with methodology that is known to us at this time. As a matter of fact, we have had the methodology for a long time. But I would like to submit one thing for the record.

This is a copy of a reprint of an article that appeared in the _American City Magazine_ in June of 1967 entitled "How To Clean Wastewater for Reuse."

The author was Mr. Gordon Culp and Mr. sigurd Hanson, and this contains a table on cost of tertiary treatment processes to produce various qualities of reclaimed water from secondary sources. And I might mention that the first process listed here is plain mixed media filtration.

The cost for a 10,000,000 gallon plant is $10.000 per million.

The effluents that this will obtain is, first of all, suspended solids, 1-5; BOD's, 1-5; COD's, 40-70.

I would like to also submit this for the record.

(The above-mentioned article, marked Exhibit No. 1, is on file at HQ, EPA, Washington, D.C. and Region VI.)

CHAIRMAN STEIN: This and the sewage treatment plant figures will be accepted as exhibits, Mr. Putnicki, since you summarized these so well.

MR. PUTNICKI: Summarize these for you?

CHAIRMAN STEIN: No. You have summarized them.

In other words, they will be noted in the record and available for inspection at our Regional Office and at Headquarters during normal business hours. But the reprint will be available in almost any library and will not appear in the record.

MR. PUTNICKI: I thank you very much.

CHAIRMAN STEIN: Thank you. Just wait a minute. I think this is largely for clarification.

Would you say with these modifications you can get this high BOD reduction of 95 and above in trickling filter plants in this area?

MR. PUTNICKI: I think this is achievable at any conventional treatment plant that is not overloaded at the present time.

You may be interested in another Texas project that is proposing to expand to a 30 MGD plant 30,000,000 gallons per day. It is a regional plant at Duck Creek at Garland, Texas. They are proposing to go to physical-chemical processes. The engineers reported at a conference last Friday that they expect to achieve an effluent of less than 10 ppm BOD and 10 ppm suspended solids, and, to do this at an operating cost of some 13 to 15 cents per 1,000.

CHAIRMAN STEIN: Again, check me on this, George. This is largely to make the report clear and for the audience. What we are dealing with here is adding a physical-chemical device onto a biological plant. The plants Mr. Putnicki has been speaking about are these trickling filter plants which have more variability -- let me say it as a nonengineer, as a lawyer -- have biological processes because they are exposed to the open.

The activated sludge plants are usually exposed and you can control the heat. You see what is happening in the plant where you see a round structure -- where an arm is going around and around -- is that the waste, after it receives its primary treatment and a good portion of the solids are settled out, it just floats over crushed rock. In between the rock and the interstices of the rock you have a film of bacteria that keep eating away at the material as it goes through this filter.

Obviously, this biological process is exposed to the weather and subject to the vagaries of temperature and various other things in a greater measure than any other secondary treatment process we might have.

I think we have had results just in terms of BOD reductions between 40 percent and 85 percent, in that wide range. But Mr. Putnicki, by putting it at a reasonable cost, is talking about physical-chemical treatment. At the end you can get pretty assured results and have high reductions in BOD and high reductions in other elements that go through the plant.

Again this is a variation on the theme you have heard before. But if this is true I think it is fairly significant.

I think it might also be fair to say that in this climate we do not have the problems that we might have with an activated, or rather trickling filter plant, such as in a place like the Dakotas, where we get these variances between the winter and summer with tremendous temperature variance.

So I think we possibly may have an easier job to control them. But I am very happy to hear that the people down here have come up with some kind of economical means. They may have effluent slime. But, from Mr. Putnicki's figures, it is economical and is a conversion to get a relatively high degree of removal, which is not too expensive. I think this is very encouraging.

MR. YANTIS: May I ask a question at this point?

CHAIRMAN STEIN: Yes.

MR. YANTIS: George, you have done quite a bit of traveling all over Texas. How many enclosed heat-controlled, activated-sludge plants have you ever seen in Texas that you have been talking about?

MR. PUTNICKI: None. I think what Mr. Stein has in mind is that in some installations --

MR. YANTIS: We are talking about Galveston Bay and Texas. Let's don't talk about up north. (Laughter.)

George, you said some of these were added physical-chemical treatment methods, which we also wish to use down at Clear Lake and can have an efficiency of 95 percent BOD reduction.

If you get the average run of sewage at about 250 ppm of BOD you would still have 12.5 ppm in the effluent.

Our Clear Lake order, I believe it was, called for 12. The Federal Government is calling for 5-5, although it knew for at least a year what figure we proposed to use.

How would you meet the 5 BOD that you have suggested using the methods that you have just outlined, which I understand are considered quite praiseworthy?

MR. PUTNICKI: All right. On the 94 to 95 percent BOD reduction, I believe I stated that this is what we were accomplishing in Richardson and could accomplish by adding chemical precipitation at a conventional biological plant to bring this down to 5.

During my discussion, when I made reference to this report in 1967, I indicated that by adding multimedia filtration to the tailend of that plant, it would give you a result that would meet the 5-5 requirement and the cost, as stated in this is $10.00 per million gallons at a 10 MGD plant. And if you want to bring that down to price per 100,000 gallons, we are talking about a dime.

So, I maintain that we can economically get down to a 5-5 level.

CHAIRMAN STEIN: Any other questions?

MR. YANTIS: No.

CHAIRMAN STEIN: Thank you.

MR. PUTNICKI: Thank you very much.

CHAIRMAN STEIN: Thank you very much.

You know, I want to say to Mr. Yantis or anyone else that if I mention the north here, it is just for illustrative purposes and nothing else. (Laughter.)

MR. YANTIS: We are not exactly mad at the north. I imagine at least a third of the people in this room have moved to Texas from up north. (Laughter.) (Applause.)

CHAIRMAN STEIN: That just proves the point about comparative purposes.

Mr. Vanderhoof?

MR. VANDERHOOF: I have one more Environmental Protection Agency witness. Dr. Clarence Tarzwell has had extensive experience on the effects of heat on aquatic life. He is especially involved in the Florida Power & Light situation, and I hope that he can relate the Houston Lighting & Power situation effects of heat on aquatic life. Dr. Tarzwell?

DR. CLARENCE M. TARZWELL, DIRECTOR
NATIONAL MARINE WATER QUALITY LABORATORY
ENVIRONMENTAL PROTECTION AGENCY
W. KINGSTON, RHODE ISLAND

Dr. C. Tarzwell

DR. TARZWELL: Mr. Chairman, conferees, ladies and gentlemen. I am Clarence M. Tarzwell, Director of the National Marine Water Quality Laboratory. I am also a member of the National temperature committee.

I have had 41 years experience in aquatic biology, including both the freshwater and marine environments. For over a year, we have been carrying on studies of the effects of a thermal electric plant on the entrained organisms.

My purpose here today is to tell you something of the effects of such a plant and to make some comments on the recommendations and conclusions of the National temperature committee and maybe a very few brief comments regarding the powerplant under consideration.

In general, a thermoelectric plant has 5 main effects. One of these is due to chlorination, which is used to keep the intake and water passage structures clear of growth. In this country, chlorination is intermittent. In England, they chlorinate continuously at a much lower rate.

Dr. C. Tarzwell

In our studies we have found that when chlorination is carried at the higher concentrations used, everything which passes through the plant is killed. This includes plankton and some of the higher organisms. In studies with zooplankton, we found that under a variety of conditions the kill was 95 to 100 percent. But generally it was almost a complete kill.

There is also an important effect which takes place in the winter and early spring. During these periods warm water is attractive to fishes, with the result that many fish come into the effluent plume and the discharge canal.

We have found that fish which congregate in the vicinity of the heated outfall are killed upon chlorination. In fact, this kill has been quite extensive at times and has included large fishes.

Thus we have found a continuous kill of those organisms going through the condensers and also a kill from the effluents containing the chlorine that is used for controlling the growth at intake structures.

A second effect of thermal electric plants is thermal shock. The organisms are in the condenser only a short period and experience an almost instantaneous

Dr. C. Tarzwell

increase in temperature. Some are invariably killed at all seasons of the year if they cannot take a rapid increase in temperature. Others do not appear to be affected.

However, in the summer months, when the water that is taken into the plant is warm, the effluent water temperature approaches or exceeds the upper lethal limit for many organisms.

When the heat which is added to the water as it passes through the condensers raises the water temperature above the lethal temperature, extensive kills result.

In dealing with temperature, there are 2 basic principles one must realize and take into consideration. One is the actual temperature and the other is the period of exposure -- how long the organisms are exposed to the thermal stress.

With short exposure, animals can generally withstand, with apparent little harm, temperatures which would be lethal with longer exposure.

As the temperature of exposure increases, the length of time to which an organism can be exposed to that temperature without harm decreases.

Therefore, you must consider both time and temperature.

The third effect of thermal electric plants is exposure to higher temperatures of the effluent plume after passage through the condensers.

Passing through the condenser is a shock that creates a stress. We have found in our studies at the National Marine Quality Laboratory that if these organisms are put back into water with the original temperature or a cooler water that many of them will survive.

However, we have found that if they are kept in heated water, such as in an effluent plume or in a long canal a much larger percent of the organisms are killed.

This is especially true in the summer period in the South where the water is naturally warm and where, when heat is added from the condensers, temperature of the water may reach levels which are rapidly lethal to the more sensitive forms and even some of the more intermediate forms.

Dr. C. Tarzwell

Of course, there are organisms that can withstand very high temperature for long periods of time.

This afterkill on exposure to elevated temperatures is the reason for many false conclusions and assumptions. Also when resistant organisms are found alive in the heated water, people jump to the conclusion that this is safe for the whole biota. This is not true.

The resistant forms that can withstand high temperatures for considerable periods are not good indicators for temperature requirements or suitable temperatures -- they provide no indication that the more sensitive and important species can survive. Because an organism survives higher temperatures for short periods is no indication that that temperature is suitable for the survival of the species or for the production of a crop of aquatic organisms.

The same mistake is generally made with oxygen. The low levels of oxygen at which certain adult organisms can resist death almost indefinitely are certainly no measure of oxygen requirements for the survival of the species.

Dr. C. Tarzwell

Temperature and oxygen requirements are tied together and are interdependent. These 2 environmental factors must always be considered together, because as the temperature goes up, more oxygen is required by the organisms for their survival, and much more is required for normal activity.

At the higher temperatures, organisms just cannot carry on their normal activities, and although they may not be killed directly, such high but nonlethal temperatures can have very serious results. It is not necessary to kill an animal directly by temperature in order to eliminate it or to wipe out a species or a group of species. Many of our most important marine organisms are sensitive to elevated temperatures.

While these temperatures are not lethal, they place a stress on them, and -- while this stress may not kill them -- it will render them unable to compete with their competitors and predators or to resist diseases and parasites with the result they decrease in number and, in time, are replaced with the more resistant and often less desirable forms.

A fourth effect of these plants occurs in areas where large volumes of water are moved from one type of habitat to another. Our estauries are nursery areas, and as such they are the most valuable marine areas, acre for acre. For the production of marine life, they are much more valuable than the water in the open ocean.

When we transfer water from an estuary to the ocean, we can change the character of the nursery in a very detrimental manner. And the movement of sea water into the estuary sometimes can render it unfavorable as a nursery, as the sea water which flows in to replace that removed is not suitable for the organisms that have been using that area as a nursery.

Another effect of a thermal electric plant is the stresses from the strong currents, and the hydrostatic effects of passing through the pump, and the vacuum breakers, etc., as they go through a plant.

In early summer, we have observed large numbers of larval menhaden and alewives in the intake canal of a thermal electric plant. These varied in length, according to season, from a fraction of an inch to an inch and a half. At this stage, their bodies are quite clear and they can best be seen by their dark eyeballs. Many were taken into the plant.

Below the plant that we were studying, all that was left were the eyes. They were torn to pieces.

The alewives and menhaden larvae are invariably killed.

The fish plankton, or larvae, do drift with the currents and are generally killed as they go through such a plant.

We also have to think about the other organisms that are important as food organisms and have planktonic stages, such as the oyster, the clam, the scallps, and the arthropods such as shrimp, crabs, lobster, spiny lobster, and others that occur in southern areas or in other areas.

If the planktonic stage of these organisms are picked up and transferred from one area to another area that is not favorable for them, the reproduction for the year can be severely harmed or practically eliminated.

If water which is not favorable, i.e., of poor quality, or polluted, or has a high salinity or low dissolved oxygen, or contains certain toxic chemicals is put into a nursery area, it can also very greatly harm that nursery area.

Another effect of such plants which I cannot say much about, because it has not been studied in the way it should be, is the effect of radioactivity.

We know it has been stated that the radioactivity contained in the discharge from atomic thermal electric plants is so low it is harmless. However, these materials can be concentrated in the food chain, and adequate studies have not yet been made to determine what the effect of long-term exposure at these low levels and passages through the food chain may be. This is something that needs a great deal of study.

CHAIRMAN STEIN: This is a fossil-fuel plant we are talking about?

DR. TARZWELL: It is.

With fossil fuel plants a possible harmful effect is the toxicity of materials in the fly ash. This is usually stored --

MR. YANTIS: These are natural gas plants; there is no fly ash.

DR. TARZWELL: Then that source of toxicity will not be there.

Now I would like to make a few comments in regard to the recommendations and suggestions which the National temperature committee has made to date.

We have been participating in conferences dealing with temperature requirements for a number of States -- those bordering Mississippi River and Lake Michigan, also California, Alabama, and New York.

Our feelings are that -- at least my feelings are that these large thermoelectric plants should be located on the open ocean, i.e., the shore where they can take their water from and discharge it into the open ocean, rather than in estuaries. This is because, acre for acre, as I have said, the estuaries are the nursery areas and are much more valuable than the open ocean water.

In the estuaries our recommendations as to temperature are that the allowable increase in temperature shall not be exceeded outside the zone of mixing at any time or any place. The zone of mixing which has been suggested for some areas -- which has not, I am sure, been accepted all over -- is that the zone of mixing should be the area enclosed within 1,000 feet as a radius from the end of the discharge pipe. In an estuary where there are tidal effects, this is not a very great area.

My acquaintance with the Cedar Bayou plant is limited. I had a man down here studying this problem. But, due to a very serious illness in his family, he cannot be here, and I have been unable to get his report. However, I have discussed it with him very briefly by telephone, and it is apparent that in this instance water is being taken from a bayou that does have salinities at times up to 10.4 - 10.5 parts per thousand in the lower water areas; that polluted water is also coming into the area with the reversal of flow and from certain industries; and that water from the Houston Ship Channel, which is often very deficient in oxygen, violates the minimum of 4 ppm which is recommended for estuaries, at least 10 percent of the time. It is my understanding that dissolved oxygen goes down as low as 2 ppm.

This water which is taken in large volume from an intake canal and put through the condenser is discharged to a 6-mile canal where the organisms are subjected to high temperatures. If they do survive going through the plant, they are subjected to high temperatures in the canal, and then discharged into a nursery area where the environmental conditions may be more favorable with the great flow -- much greater than the natural flow coming into Trinity Bay at low stream flow.

As I understand it, the ditch is being constructed to handle 5,000 cfs, which is a tremendous flow into Trinity Bay.

I believe that in this instance, my recommendations -- and I think those of the National temperature committee -- would be that such an installation should be located on the open ocean where the valuable nursery area would not be harmed and more water would be available for dilution.

CHAIRMAN STEIN: Let's suppose they were going to be located here, Dr. Tarzwell.

I recognize that you had one of your Assistants, Dr. Prager, down here who, unfortunately, couldn't be with us, but supposing they were located here in this inland water. The recommendation we had this morning was they put in cooling towers or recirculation devices which would permit temperatures of no more than a 4° rise in the winter months and 1.5° rise in the summer months. With your work on the National Technical Advisory Committee and the temperature committee, what do you think of that?

DR. TARZWELL: Well, as I see it, from the short time I have been here, there would I believe be a violation of the salinity allowable in our Water Quality Criteria commonly known as the green book.

CHAIRMAN STEIN: Yes.

DR. TARZWELL: Evaporation in the cooling towers is going to make that worse and not better. The oxygen in the water that is taken in would appear to be low. Whether this could be restored or not, I do not know. If there is a cooling pond photosynthesis will increase DO levels at least part of the day.

Because the water is warm in this part of the country, there will be growths of bluegreen algae, which are heat resistant. In other words, I believe these algae will increase and dominate the population.

When the temperature is high, there would be reduction of oxygen at night in a cooling pond even if it were a large one and shallow. This would be due to the nutrients and the high temperature. If the temperature, as you say, was lowered to an increase of 4° in the winter and 1.5° in the summer, this would meet the requirements if it could be accomplished.

The cooling ponds, I am quite sure, would probably have such tremendous growth of the bluegreen algae that there would be depletion of oxygen at night, and I think it would be touch and go to meet those requirements. I don't believe it has been proven. To be frank with you I would be skeptical of this being able to reach it.

CHAIRMAN STEIN: Your suggestion is reappraisal of the location of the site then?

DR. TARZWELL: Yes, sir.

CHAIRMAN STEIN: Are there any other comments or questions?

MR. QUARLES: I have none.

CHAIRMAN STEIN: Mr. Yantis?

MR. YANTIS: No.

CHAIRMAN STEIN: Thank you, very much. Let's recess for 10 minutes.

(Whereupon the conference recessed.)

CHAIRMAN STEIN: Let's reconvene. Mr. Vanderhoof?

MR. VANDERHOOF: Mr. Gallagher, would you inform the group on the type of alternatives, whether freshwater or salt water, that we are discussing?

MR. GALLAGHER: Yes, sir. Mr. Vanderhoof, I think the alternatives that we were suggesting for the Houston Lighting & Power plant at Cedar Bayou is a freshwater system.

Dr. Allen discussed the merits of the freshwater system and the availability of freshwater, and we had decided it was a viable alternative, at least on first examination.

I wonder if Dr. Tarzwell would like to enlarge his comments given that variable?

DR. TARZWELL: Mr. Vanderhoof, I'm sorry, I did not know that freshwater recirculation in cooling towers was under consideration.

The things I said would apply with marine cooling ponds and also marine waters used once-through for cooling.

With the freshwater recirculating system, of course, the only thing that would be wasted would be blowdown and evaporation. This would take a certain amount of freshwater. But in this instance you wouldn't have the adverse effect of passage of the organisms through the plant in large numbers with large volumes of once-through cooling water. You would not have the poor water coming in and being used originally for cooling, and you would not have some of the other adverse effects that occur with once-through cooling.

I was only speaking with regard to salt water cooling and in regard to the cooling tower for lowering the temperature to meet the stated requirement making the situation work.

MR. VANDERHOOF: Dr. Tarzwell, you were partly -- well the situation is that Houston Lighting & Power Company does propose salt water cooling and a cooling pond. Many of the statements you made do apply to that situation.

DR. TARZWELL: Yes, sir.

CHAIRMAN STEIN: If they had a freshwater source, you would feel that they could have a cooling tower and recirculation?

DR. TARZWELL: I believe so, with a minimum of damage, yes, sir.

CHAIRMAN STEIN: All right. Thank you.

Mr. Vanderhoof?

MR. VANDERHOOF: We have two Federal Agencies that would like to present a statement.

The first one is from the Food and Drug Administration, Mr. Victor Casper.

MR. VICTOR CASPER

REGIONAL SHELLFISH CONSULTANT

U.S. FOOD AND DRUG ADMINISTRATION

DALLAS, TEXAS

V. Casper

MR. CASPER: My name is Victor Casper. I am Regional Shellfish Consultant, representing the U. S. Food and Drug Administration. My statement of interest regarding the pollution affecting shellfish in Galveston Bay is made within the framework of the National Shellfish Sanitation Program which is administered jointly by the States and FDA. In my opening remarks, I would like to briefly review the development and structure of the National Shellfish Sanitation Program and FDA's responsibility in administering that program.

Epidemiological investigations of disease outbreaks attributed to the consumption of raw shellfish reveal two basic avenues of contamination. One is the water from which they are harvested or stored after harvest, and the other is contamination by unsanitary practices during processing. Of the two sources, polluted shellfish growing waters is the factor most often implicated in shellfish-caused illness.

Shellfish obtain food by pumping large quantities of water through their bodies and filtering out particulate material which may give them nourishment. This process is not very selective and many different materials including bacteria, toxic heavy metals, and hydrocarbons may be concentrated to a high degree, either directly or through the food chain.

As early as the 17th century, shellfish were suspected of causing illness and by the end of the 19th Century repeated outbreaks of typhoid fever associated with shellfish were causing concern to public health officials in the United States.

Then in 1924 a massive typhoid fever epidemic traced to oysters prompted State and local health authorities and representatives of the shellfish industry to request the U.S. Public Health Service to exercise supervision over the sanitary quality of shellfish shipped in interstate commerce. In accordance with that request, a cooperative control program was established in which the Public Health Service, the States, and the shellfish industry each accepted responsibility for certain phases of the program. Each State program is annually evaluated by the FDA for compliance with the N.S.S.P. recommended practices.

The fundamental concepts of the National

Shellfish Sanitation Program are contained in the *Manual of Recommended Practices for the Sanitary Control of the Shellfish Industry*, Parts I, II and III.

Copies of the Manual are submitted for the record if requested.

The Manual contains the administrative and technical criteria which have been developed and periodically updated through cooperative efforts of State and Federal experts in public health and shellfish sanitation.

The molluscan shellfish industry, State Shellfish Control authorities and the Public Health Service have participated in the national program since 1925. The program guidelines and procedures have been time tested and are used throughout the Nation's shellfish producing areas. The major objectives of the national program are to assure that shellfish shipped in interstate commerce are safe for human consumption and to encourage water quality programs which will preserve potential shellfish-producing areas for this beneficial use.

Evidence of this program's success is the fact that no confirmed incidence of illness due to microbiological or chemical contamination has been traced to shellfish harvested from approved growing areas which had been properly classified in accordance with the National Shellfish Sanitation Program *Manual of Operations* and which had been properly processed after harvest. On the other hand, harvesting from nonapproved and improperly classified areas or improper storage have resulted in outbreak of shellfish-borne disease.

The Food and Drug Administration recognizes the importance of water quality as related to the wholesomeness of all fisheries' products. Recent detection of hazardous amounts of mercury in fish and shellfish has initiated an increased concern over the numerous environmental contaminants that may enter the food chains and be concentrated in a wide variety of foods.

Approximately 2,000,000 acres of shellfish waters in the United States are closed because of pollution and other factors. Most of these closures are due to microbiological contamination, but closures due to trace metal and petroleum contamination are beginning to be identified. Recently two States have closed areas due to mercury contamination and three States took precautionary action by closing areas as a result of oil spills.

Louisiana oyster reefs were threatened by the now infamous Breton Sound ruptured oil wells, but were fortunate to have prevailing seaward winds. No oil damage occurred to the oysters in this instance.

Water quality in shellfish growing areas of Galveston Bay has been of concern to State and Federal control agencies for many years due to the proximity of shellfish beds to a heavily populated and industrialized metropolitan area. Consequently, the National Shellfish Sanitation Program's guidelines of a survey every 10 years and reappraisal every 2 years has been replaced by a continuous surveillance program to ensure that Galveston Bay shellfish harvesting areas are properly classified.

The classifications of areas for shellfish use such as Galveston Bay requires extensive knowledge and understanding of the many factors which may affect the growing waters and shellfish quality. Among the requirements for proper classification are: 1) Detailed shoreline and reconnaissance surveys; 2) Water quality studies; 3) Analysis of shellfish meats; 4) Analysis of all available information in light of current public health criteria and standards.

In Galveston Bay, major emphasis has been placed on bacteriological evaluation of the growing waters (including the effects of meteorological and hydrographic conditions), and analysis of oyster meats for trace metals, pesticides and bacteriological quality.

Past history has shown that periods of closures will be required as a result of heavy rainfall or high tides. The last such incident occurred in February 1969, following an intense storm which produced extreme high tides, flooding of low-lying areas, and flushing of the Houston Ship Channel. The bay was closed to harvesting the day after the storm and remained closed until water and oyster bacteriological data indicated the area to be suitable for reopening.

The closure extended from February 15 to March 3, 1969. Extent of economic loss due to this closure has not been estimated. Temporary closures of shellfish growing areas due to bacteriological pollution during periods of high runoff is not unique to Galveston Bay. For example, in calendar year 1969, portions of Narragansett Bay, Rhode Island, were opened and closed 13 times because of bacterial contamination from urban runoff waters. Mobile Bay, Alabama, is closed for extended periods almost yearly.

Detailed evaluation of over 3,000 bacteriological samples from 84 water sampling stations and related hydrographic and meteorological data in addition to over 750 oyster samples collected by the Texas State Department of Health since 1963, indicate that the shellfish industry has a quality product available. There has been no consumer complaint or confirmed cases of illness traced to the consumption of Galveston Bay oysters.

The coliform criterion used alone in evaluating sanitary quality of a growing area is wholly inadequate. When employed by control officials, bacteriological information is used to interpret sanitary survey data. In all classifications of shellfish waters throughout the Nation, bacteriological criteria are used as an adjunct to the sanitary survey. Any bacteriological indicator system must meet rigid public health scrutiny. Studies conducted by the FDA Gulf Coast Technical Services Unit at Dauphin Island, Alabama, have shown the coliform group of organisms to be ubiquitous in estuarine waters and upland soils, and most especially, in southern soils. The fecal coliform test has been proposed as a more specific indicator of warm-blooded animal pollution. At the present time there is no universal agreement among public health experts as to the advisability of accepting a fecal coliform criterion.

Past concern over pesticide and trace metal contamination has resulted in several cooperative State-Federal and State studies. More recent concern over hydrocarbon contamination has resulted in initiation of studies by FDA to evaluate these substances.

Cooperative studies by the Texas State Health Department and the Gulf Coast Shellfish

Sanitation Laboratory in 1964 and the Texas Parks and Wildlife and U. S. Bureau of Commercial Fisheries since 1966 showed that chlorinated hydrocarbon levels in oysters were of no known public health significance. Oysters collected from Galveston Bay and analyzed for chlorinated hydrocarbons by the FDA in May 1971 were also well below present guidelines.

Trace metal analyses of oyster meats collected by the Texas State Department of Health and Texas Parks and Wildlife from Galveston Bay between August 1968 and December 1970 and analyzed by the Gulf Coast Water Hygiene Laboratory showed concentrations similar to those of other approved Gulf Coast areas. The trace metal results do not reflect any significant effect from industrial waste sources upon presently approved oyster growing areas.

Results of studies of hydrocarbon content of oysters from approved growing areas in Galveston Bay conducted by FDA in cooperation with Texas State officials have not demonstrated levels of toxic fractions considered to be of health significance based upon present knowledge of hydrocarbon toxicology and analytical methodology.

The oyster samples were also examined for visible signs of oil and odor of petroleum distillates. Neither FDA nor Texas State officials who were experienced in such examinations detected any visible signs of oil or odors of petroleum in oysters examined from approved areas in Galveston Bay.

The Food and Drug Administration has studied thoroughly the Environmental Protection Agency's report on _Pollution Affecting Shellfish Harvesting in Galveston Bay, Texas_ and reviewed in detail the Texas State Department of Health's sanitary survey files and Food and Drug Administration data. Our conclusions are that 1) Approximately 150,000 acres in Galveston, Trinity, East and West Bays are polluted to the extent that the areas cannot meet the requirements for the approved classification; 2) FDA supports an effective pollution abatement program to give added protection to approved and conditionally approved areas and, if possible, to enable portions of potential and actual producing areas which are now closed to be reopened; 3) With continuing thorough surveillance of the Galveston Bay complex and frequent reevaluation of sanitary survey data, the shellfish industry can be assured of a safe source of shellfish from approved growing areas.

The Texas Shellfish Sanitation Program is given a comprehensive evaluation annually in accordance with the National Shellfish Sanitation Program _Manual of Operations_. The Texas State program has always been in compliance and continues to receive the endorsement of the Food and Drug Administration.

Thank you.

CHAIRMAN STEIN: Thank you, Mr. Casper. Any comments or questions?

MR. VANDERHOOF: I have a question.

Did you mention National requirements for quality? Is this tied in with some -- did you mention some documents that you had for the national requirements?

MR. CASPER: Right.

The National Shellfish Sanitation program _Manual of Operations_, Part I.

MR. VANDERHOOF: Does this include something other than bacterial coliform?

MR. CASPER: This includes requirements that there not being toxic levels of any trace metals, any other toxic substandards such as pesticides and biotoxics as a result of toxic marine organisms.

MR. VANDERHOOF: Have any shellfish areas anywhere been closed because of hydrocarbons?

MR. CASPER: The West Falmouth area in Massachusetts was closed as a result of an oil spill. I don't know the exact date. It is in your EPA report quite well detailed. The initial closure was due to taste and odor problems.

Then the additional analytical procedures, analytical analyses, were made and you have these results in your report.

MR. VANDERHOOF: Now, with the hydrocarbons as reported, could this be called a potential health hazard?

MR. CASPER: This would be called a potential health hazard.

This has been thoroughly discussed and reviewed by the Food and Drug Administration toxicologists and the Bureau of Food in Washington.

They have, in reviewing the data that we have collected thus far, as stated, seen no indication of any toxic hydrocarbons. This information or data or analyses are still being conducted. We will have additional information as it is available and it will be made available to the Environmental Protection Agency as soon as it is completed.

MR. VANDERHOOF: Did I understand you to say this then is a potential health hazard?

MR. CASPER: It depends on how you define "potential." Not based on what we know at the present time of the toxicity of these hydrocarbons.

MR. VANDERHOOF: I have no further questions.

MR. YANTIS: Mr. Chairman, I have no questions either. I think the man covered the subject so thoroughly, professionally and competently I don't see how I could have a question.

Thank you.

CHAIRMAN STEIN: I knew before the day was out we would get a response like that from the man. (Laughter.)

Thank you very much, Mr. Casper.

MR. VANDERHOOF: I have one more Federal Agency that would like to make a statement.

Mr. Jack Rawson of the U. S. Geological Survey.

MR. JACK RAWSON
U. S. GEOLOGICAL SURVEY
AUSTIN, TEXAS

MR. RAWSON: Mr. Chairman, conferees and ladies and gentlemen. I am Jack Rawson of the Texas District of the Geological Survey.

I would like to make a very brief statement on behalf of A. G. Winslow, Acting District Chief.

[The above-mentioned statement follows.]

U.S. GEOLOGICAL SURVEY WATER - QUALITY PROGRAMS IN THE HOUSTON - GALVESTON BAY AREA, 1971 FISCAL YEAR

By
A. G. Winslow
Acting District Chief

The U.S. Geological Survey, in cooperation with various State, Federal, and local agencies, operates a network of daily and periodic water-quality and streamflow stations on streams in Texas. In addition to providing water-quality information for locations where water-development projects are likely to be built, this network provides data that aid in determining the effects of urbanization on water quality, in the delineation of areas having water-quality problems, and in the identification of sources of pollution.

Currently, 42 water-quality stations in the network are located in Houston-Galveston Bay area. Agnecies that cooperate in the collection of data from these stations include the Texas Water Development Board, City of Houston, and Texas Water Quality Board (Galveston Bay Project). The attached table identifies the stations by downstream order number and shows the cooperating agency and the type and frequency of sampling. As indicated on the attached table, water discharge or stage is measured at each site where water-quality data are collected.

Water-quality records for stations operated in cooperation with the Texas Water Development Board date from September 1968, those in cooperation with the City of Houston date from July 1970, and those in cooperation with the Galveston Bay Project date from May 1971. The records are transmitted to cooperating agencies and the Environmental Protection Agency on a current basis, are published annually, and are made available to interested agencies or individuals upon request.

The Geological Survey recognizes the magnitude of the water-quality problems in the Houston-Galveston Bay area and offers its assistance in inventorying and monitoring the quality of the water resources in the area.

Prepared by: Jack Rawson
June 3, 1971

MR. RAWSON: Thank you.

CHAIRMAN STEIN: Thank you.

Any comments?

(No response.)

CHAIRMAN STEIN: Thank you very much.

MR. VANDERHOOF: Are there any other Federal Agencies present that would care to make a statement?

(No response.)

MR. VANDERHOOF: If not, Mr. Stein, that concludes the Federal program.

CHAIRMAN STEIN: In accordance with the agreement we have made beforehand, beginning tomorrow we will call upon the State of Texas and its invitees.

At this point we will recess until 9:30 tomorrow morning when we will convene right in this room.

(Whereupon the conference recessed until 9:30 a.m., June 8, 1971.)

9:30 a.m., Tuesday, June 8, 1971
A.M. SESSION

CHAIRMAN STEIN: Let's reconvene.

I would recommend to the conferees that we speak directly into the microphone, as we had reports yesterday that some of the people in the back had difficulty hearing, particularly when we turned our heads.

Today we are going to start with the State of Texas presentation. Before we begin that, Mr. Vanderhoof has asked to make a brief remark.

Mr. Vanderhoof?

MR. VANDERHOOF: Thank you, Mr. Chairman. We have a couple of requests left over from yesterday's proceedings. I would like to request that the record be kept open to receive the guidelines for oil and hydrocarbons and heavy metals and data which Mr. Casper of the Food and Drug Administration referred to yesterday and to incorporate those into the record.

Second, we would also like to submit for the record at a later date, a letter from the Massachusetts Environmental Health Officer, dealing with closing the shellfish beds in West Falmouth Harbor, Massachusetts, due to levels of oil and hydrocarbons, toxic and undesirable for human consumption, as documented in the EPA report.

CHAIRMAN STEIN: From the looks of things, unless the witnesses who said they want to appear do not come, we may be here for another 2 days.

Where is that letter?

MR. VANDERHOOF: It is in Denver.

CHAIRMAN STEIN: Why can't we get a copy of that letter either dictated over the phone or sent by teletype? We can put it in the record before we adjourn the conference.

Why isn't it possible to get the guidelines from the Food and Drug Administration on the same basis?

MR. VANDERHOOF: We will make the request to them.

[The National Shellfish Sanitation Program Manual of Operations, Part I is contained in the Federal report of this transcript. Parts II and III are marked as Exhibits and are on file at Headquarters, Environmental Protection Agency, Washington, D. C., and Region VI, Dallas, Texas.]

[The above-mentioned letter follows.]

THE COMMONWEALTH OF MASSACHUSETTS
Department of Public Health
600 Washington Street, Boston, Mass. 02111

Division of
Environmental Health
Room 320

June 16, 1970

Mr. Frank Grice, Director
Division of Marine Fisheries
Department of Natural Resources
100 Cambridge Street
Boston, Massachusetts

Re: Falmouth - Bourne
Buzzards Bay
Continuation and Expansion
of Emergency Closure of
Shellfish Area

Dear Sir:

The Department of Public Health has caused a re-examination to be made of the shellfish area in Buzzards Bay in the Town of Falmouth, which was closed to the taking of shellfish for food purposes on September 18, 1969, because of pollution by oil accidentally discharged to tidal waters when the oil barge "Florida" went aground off Chappaquoit Point in Falmouth on September 16, 1969.

The results of the examination show that the area in Buzzards Bay closed since September 18, 1969 continues to be polluted by oil deposits and that shellfish harvested from this area are unfit for food purposes and may be dangerous to the public health.

The Department has also caused an examination to be made of Megansett Harbor in the Towns of Falmouth and Bourne. The samples of shellfish collected from this area during the survey were delivered to Dr. Max Blumer, Senior Scientist, at the Woods Hole Oceanographic Institution Laboratory in Falmouth for analysis. The results of the analyses show the presence of oil in all samples. As a result of the above, the Department is of the opinion that the shellfish harvested from these areas are unfit for food purposes and may be dangerous to the public health.

Therefore, the Department of Public Health acting under the provisions of Section 74A of Chapter 130 of the General Laws as amended by Chapter 288 of the Acts of 1966 hereby determines that the Buzzards Bay shellfish area as defined below be closed to the taking of shellfish for food purposes:

> The waters and flats of Buzzards Bay, its estuaries and tributaries located inside or east of a line drawn from Chappaquoit Point at the entrance to West Falmouth Harbor in a northerly direction to the easternmost point of Amrita Island in the Town of Bourne.

In compliance with the provisions of Chapter 288, of the Acts of 1966, such designation is herein reported to the Director of the Division of Marine Fisheries and the Director of the Division of Law Enforcement, who shall take the necessary action to prevent the taking of shellfish from the above designated area for human consumption, and so notify local authorities. Such determination shall be in effect until subsequent examinations initiated within 30 days show that the above mentioned shellfish area is free from oil pollution.

Very truly yours,

John C. Collins
Director
Division of Environmental Health

C - Kenneth Crossman, Director
    Division of Law Enforcement
    100 Cambridge Street, Boston
C - Mr. Thomas McMahon
    Water Pollution Control
    Department of Natural Resources
    100 Cambridge Street, Boston
C - Mr. Charles D. Larson
    Regional Shellfish Consultant
    585 Commercial Street, Boston
C - Board of Health, Falmouth
C - Board of Selectmen, Falmouth
C - Board of Health, Bourne
C - Board of Selectmen, Bourne
C - Walter S. Reynolds
    Shellfish Warden
    12 Holt Road
    Buzzards Bay, Mass.
C - George Souza
    Shellfish Warden
    114 Acapesket Road
    Falmouth, Mass.
C - Barnstable County Health Department
    Barnstable County Court House
    Barnstable, Massachusetts
C - Arnold Carr, Biologist
    Division of Marine Fisheries
    Shawnee Crowell State Forest
    Sandwish, Massachusetts

#821-1969
C/Emuca

THE COMMONWEALTH OF MASSACHUSETTS
Department of Public Health
600 Washington, Street, Room 320
Boston 02111

Division of
Environmental Health

June 18, 1970

Mr. Frank Grice, Director
Division of Marine Fisheries
Department of Natural Resources
100 Cambridge Street
Boston, Massachusetts

Re: Falmouth - Bourne
Buzzards Bay
Correction of Definition
of Closed Area

Dear Sir:

In a letter to you from this Division dated June 16, 1970, (Re: Falmouth - Bourne, Buzzards Bay, Continuation and Expansion of Emergency Closure of Shellfish Area.) an error was made in the wording of the definition of the area to be closed to the taking of shellfish. The word "easternmost" in the fourth line of the definition should be changed to "westernmost" and the definition would then properly read:

> The waters and flats of Buzzards Bay, its estuaries and tributaries located inside or east of a line drawn from Chappaquoit Point at the entrance of West Falmouth Harbor in a northerly direction to the westernmost point of Amrita Island in the Town of Bourne.

Very truly yours,

John C. Collins
Director
Division of Environmental Health

#821- 1969
C/Emca

C - Kenneth Crossman, Director
Division of Law Enforcement
100 Cambridge Street, Boston
C - Thomas McMahon
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C - George Souza, Shellfish Warden
114 Acapesket Road, Falmouth
C - Arnold Carr, Biologist
Division of Marine Fisheries, Sandwich
C - Barnstable County Health Department
Barnstable County Court House, Barnstable

CHAIRMAN STEIN: Thank you.

Mr. Yantis?

MR. YANTIS: Mr. Chairman, I am Hugh Yantis, Executive Director of the Texas Water Quality Board. I was designated by the members of the Texas Water Quality Board to be the conferee for this meeting.

The spokesman for the State of Texas who will open will be the Chairman of our Board. I will, however, introduce him this way: Some years ago, when he was a newspaper editor in Austin, Texas, he became acquainted with young John Connally. John Connally grew up to be Governor of Texas and is now the Secretary of the Treasury. John Connally, after a lifelong friendship, appointed Gordon Fulcher to the Texas Water Quality Board.

The members of the Board elected him and have reelected him as Chairman of the Water Quality Board.

So, at this time, the opening comments for Texas will be made by Chairman Gordon Fulcher.

MR. GORDON FULCHER, CHAIRMAN
TEXAS WATER QUALITY BOARD
AUSTIN, TEXAS

G. Fulcher

MR. FULCHER: Mr. Chairman, members of the conference committee, ladies and gentlemen. Ordinarily under circumstances like this, I would be extending to you Texas' most hospitable and warm welcome. But being that my mother always took a dim view of my telling stories, I think I just better skip it both ways. (Laugher.)

Now, it disheartened me very much, Mr. Stein, yesterday morning to hear your opening remarks -- that unlike some of the cases that our famous and late Judge Roy Bean once held out at Pecos, you were going to let us put on our case and say whatever we wanted to in our defense. And unlike Judge Bean, it was not, again, to be one of those situations where you were going to give us a fair trial before you hanged us. (Laughter.) Now, if we look with a bit of trepidation and askance and a little -- as we would say down here in Texas -- skitterish about that, you will have to understand that in similar circumstances with your organization and its predecessors, we have been snakebitten so many times that we are somewhat like the catfish who began to rise mightily when he looked up and saw the colored man with the buthcer knife standing over him. And he heard the colored man say, "Just lay still catfish; we ain't goin' to do nothin' to you except gut you." (Laugher.)

Now, the other night when I got here, I was kind of late arriving, and I had a note from Mr. Yantis and Mr. Teller to join them across the street over at Kelley's Restaurant -- that they were eating supper. When I walked in they had gone way to the back and sat down. But right there at the entrance I passed some of your people, and, to my great amazement and alarm, they were eating the shellfish and other products from the Texas Coast. (Applause and Laughter.)

Then I thought to myself, Oh, my goodness! These people haven't read this black paper here and somebody might drop dead before morning, and I was so scared. It kind of shook me up pretty badly.

CHAIRMAN STEIN: Those people might have been "Achilles heels." (Laughter.)

MR. FULCHER: But then after hearing Mr.

Casper, from the Food and Drug people, whom I would have to assume, since he isn't one of your bunch or one of ours, he might have been an unprejudiced witness -- (Laughter) -- say that it was all right to eat something that came out of the Galveston Bay and the approved areas as far as he knew. And he said, since 1925 nobody had been made sick, or no one was known to have died over it, and it was all right to go ahead and eat something out there -- oysters or shrimp or fish or something like that. So I felt an awful lot better about your folks I saw over there Sunday night.

Now also after hearing Mr. Casper, I don't know exactly what this conference is about, because I thought we had come down here to save the shellfish industry and to protect people from eating contaminated foods.

You are here in the heart of the largest industrial complex in the Nation -- if not in the world.

Let me say that personally, not officially, I am glad to see you all come, and welcome to Texas. I want the record to clearly show, however, that that is unofficially personally. (Laughter.) The materials produced here have played a key role in the remarkable progress of these United States, and there can be no doubt but what that progress has been of immeasurable benefit to all of us in this Nation.

We must acknowledge also that with this progress have come problems, not only those associated with the environment but with labor and with a broad range of situations.

As might be expected we have problems here too, and I am most concerned with the problems of water quality.

This massive industrial complex, with its attendant labor force and accompanying population boom does of itself create problems of water quality. The State of Texas has recognized this and has set into motion the machinery to achieve correction.

The Executive Director of the Texas Water Quality Board will trace the history of this corrective action for you in a few moments. I wish now to point out that an effective program to correct these problems has been in force and that significant, measurable improvements have resulted.

G. Fulcher

I would have to pause here a moment from my prepared text and say that, you know, I used to think that there weren't very many people that were so sufficiently awfully bad that there wasn't something good about them now and again. But when I heard Mr. Gallagher read the report, and I had previously read it myself, one who just picked it up cold would assume, I think, the Texas Water Quality Board had never done anything worthwhile -- that we just willfully, maliciously and with malice aforethought were set up to create these situations, to aggravate them and to perpetuate them. I don't think that quite is the case.

Allowed to continue our program that we have instigated in a sound, sensible and practical manner, I think I can assure you that there will be continuing improvements in the water quality in the Houston-Galveston area and including, believe it or not, the Houston Ship Channel.

Past improvements and expected future ones will be documented for you in the State presentation which follows my comments.

G. Fulcher

Water quality problems have not arisen in one big bang, and there is no instant solution. While the State program has made great strides toward accomplishing the necessary improvements, much remains to be done. Quite likely there will never be a complete solution in Texas or at any other place in our Nation. We must look forward to a continuing program to keep pace with future growth and progress.

In Texas we have had 10 years of experience with a statewide effluent control system -- a longer period of time, I might add, than in any other State and certainly longer than that of the Federal Government, whose claims to all encompassing expertise, despite very recent entry into the field fill me with considerable concern.

In Texas, our extensive experience in these matters has led us to the firm position that litigation as an enforcement tool must be preceded by extensive efforts if we are to achieve compliance. I was therefore most encouraged when Mr. Ruckelshaus and Mr. McFarland, in a recent meeting at EPA Regional Headquarters in Dallas, assured me in clear and concise language that no Federal actions, and especailly litigation, would be initiated without first consulting with the State to determine what action was being taken by the State agencies.

I was most heartened by this attitude, especially since it was so strongly enunciated by the official in top authority with the Environmental Protection Agency. I think then that perhaps you can understand my utter dismay and frustration when later I learned -- from a newspaper article -- that the Federal Government had initiated legal action against a Texas industry without any consultation with us. And then magnifying that feeling of frustration when two days later your Mr. David Dominick called me on the phone and said, "We are going to have this conference down there." I said, "Well, David, what are we accused of?" And he said, "We are going to announce the conference; I will let you know later what you are accused of."

Now it had always been my thought that we operated in this country with at least filing a Bill of Particulars before you indict somebody.

Further it is my feeling in this regard that further litigation, further actions, with utterly no consultation with the State has been taken, despite Mr. Ruckelshaus' representation. And they continue and are on the increase.

I suppose I should be able to find polite words to express my reaction, but it would still boil down to the fact that I feel I have been -- me and the State of Texas -- have been dealt with most unfairly and in a manner certainly not in the best interest of achieving the goal we both seek -- cleaning up present pollution and achieving the best possible water standards.

It would seem that cooperation on the EPA level occurs only when it suits that Agency's own purposes.

As chairman of the Texas Water Quality Board, I have served under the assumption that the Environmental Protection Agency had essentially the same interest as does our Agency -- i. e., the proper management of water quality.

I am rapidly coming to the conclusion that EPA's actions are based more solidly on political expedience than on sound water quality considerations.

If the Environmental Protection Agency is so dissatisfied with the efforts of the Texas Water Quality Board, why has it not expressed its reservations to us? It might just be that we from time to time might wish to join in litigation.

The EPA, among others, is notified of each application the Texas Water Quality Board will consider, and on only one occasion in the past 4 years has the Federal Agency seen fit to express its views to us. We do not operate in a vacuum, and any person who has attended a meeting of the Texas Water Quality Board can tell you of the detailed consideration which both the staff and the board give to each application.

Now we think that if you people think we are wrong you ought to get up and say so when we have examiners' hearings on these cases. I think you ought to bring them up to us and discuss them with us. And I am not saying that, even every now and then, you might not be right. But we would like to hear you before the horse gets out of the barn, instead of being asked to close the gate after the decision has been made

We would welcome any input which would help us in those deliberations, and when we receive no comment from the Federal Government we can only assume that its representatives are satisfied with the requirements we impose.

Now, after 4 years of almost unbroken silence, we find a document filled with implications of dissatisfaction. I simply do not understand how this can conceivably be called a cooperative effort to help with the monumental job of water quality management.

No one is more concerned about the protection of our environment in Texas than the Texas Water Quality Board, or than am I personally. However, we feel compelled to point out that using a sledge hammer to kill flies causes more damage than do the flies themselves.

For example, you know the tremendous furor that was raised nationwide about mercury poisoning last year. However, I know very little has

G. Fulcher

been said about this, since some scientist discovered that there was mercury in fish which had been caught and preserved in the scientific laboratories for about 50 years. What this means I really do not know, but it could well mean that there is quite a lot of mercury loose in the environment from natural sources and that it is not altogether due to man's activities.

In passing, I might add that a friend of mine, who is an exceptionally competent engineer, recently analyzed a sample of bottled water -- supposed to be the purest drinking water available -- and found traces of mercury in it.

Now comes a report from the University of Wisconsin by Professor G. B. Lee who has found that 60-year-old soil samples show apparent traces of DDT-type insecticides, although they have been tightly sealed in glass jars for 30 years. This is quite some time before such insecticides were developed.

Professor Lee says that there are apparently compounds in soil which will give a reading for chlorinated hydrocarbons when none are present and that it is sometimes necessary to do two or three readings on the same sample, using different kinds of testing.

G. Fulcher

He said that when he tested the 60-year-old soil two and three times, nearly all reverted to zero, thus underscoring the importance of doing more than one analysis, or arrive at an overall sweeping decision on once-over—lightly application.

Professor Lee raises an interesting question, and I don't know but that he is right. But it seems to me that some of these things are being suddenly approached with a great deal of hysteria instead of a lot of common application. And to me I think it would be rather a tragedy to ban all insecticides per se and create a famine when we wake up one day and find that they weren't the cause of it at all.

Now I certainly, as Chairman of our board, have advocated that we do not do all studying and no action, and this was long before you folks got on that kick yourselves. But I don't think that it would be very wise to abandon all study and immediately make decisions on a shooting from the hip basis.

Last winter in the Armco cyanide situation the district Regional Office of the Federal Agency was very insistent that we solve the problem by requiring that this waste be chlorinated as a simple and relatively inexpensive solution to the problem.

I thought, this is just great, when I got Mr. Vanderhoof's letter and his phone call, and I went rushing in to take the matter up with Joe Teller. He advised me that because of resulting chlorinated phenolic discharges into the channel, such a treatment as proposed by the Federal Agency would cause marine products taken from the Gulf to taste so bad as to be both inedible and unsalable.

Now, it just occurs to me that should we follow that course, accepting unequivocally the recommendation that was made to us, we might have caused more economic loss to the shellfish industry and the fishing in Galveston Bay than you are fearful is occurring now.

Finally, the Regional Office dropped its proposal and then went to a proposal for burning this waste by using some 8,000,000 cubic feet of natural gas every day. Not only would this substitute an air pollution problem for the water pollution problem but it would constitute a wasteful use of another acutely needed and increasingly precious natural resource.

All of this was proposed in lieu of the Water Quality Board's approval of disposal by a deep discharge well. This is not a method of which we are enamoured. As a matter of fact, we think that there is going to come a day when underground sources of brackish water are going to be desperately needed and will have to be brought to the surface and used for everyday domestic use. So only in the greatest extremity and in the case where we think it is the only possible, feasible solution to recommend a discharge well at all, do we do it? We just don't go off willy-nilly with it being a panacea for all ills.

In this case we do so. It was the most feasible, most practical, and up to now the only one that we consider has been brought up that is an adequate substitute. Certainly we prefer it over burning or over chlorinating it so that we can't get anything out of the Gulf, whether the FDA approves it or not, because it smells so bad and tastes so bad nobody wants it. Now the proposals received from your Agency cause me to think, Oh! Its technical people are no more capable than ours, and it certainly doesn't give me reason to believe that we will abdicate the field in their favor.

To be utterly blunt about it, I believe the State of Texas has more able, better informed, and by far more practical people on its staff at the Water Quality Board than has the Federal Agency.

The Texas program is not perfect, but neither is it ineffective, as implied by your black paper. Our efforts have, in part at least, been responsible for some of the improvements which have been made.

And here I would like you to remember that we operate over a State that is as large as at least 5 or 6 average States in this country, and that to find the diversities with which we must contend, you would have to go from the coast of Carolina to the coast of California to find an equal diversity. Just going from Lake Michigan to the Gulf wouldn't do it.

Now we have all manner of problems with which we deal. I would remind you also that we have operated, up until the coming biennium, on something like 20 cents per capita per year for water quality control. That is less money, I am unhappy to say, than the State Highway Department spends each year picking up beer cans off the highways. And I am not talking about the rest of the trash; I am just talking about the beer cans.

So we haven't exactly been broken out with money. I want to say to the credit of my staff I think that they have made the most out of the money. I think they have done a heck of a good job with what they have had to do it with. I am proud of them. They have never watched the clock, and they have worked far and beyond what the normal call of duty of a public employee is, and I think they deserve a hand of credit and a rose every now and then among the brickbats. I hope this will be considered one.

The Texas program, as I said, is not perfect. But at this point of reference, we know that the industrial community in this area has made significant investment in waste treatment facilities. While no effort has been made to tabulate all industries, we can document a capital investment in excess of $90 million in waste treatment facilities. This not insignificant expenditure for waste treatment is reflected in the sharp decrease in organic materials being discharged to the Houston Ship Channel.

Now, we have had a few unpleasantnesses down here, and I suppose up in Washington you don't always get the Texas papers, particularly Mr. Scarlett and the Houston Post and his counterpart in the Houston Chronicle. We have had a few harsh words exchanged between the city officials and the Texas Water Quality Board, and I do think that we have got a rather improved situation here in Houston as regards corrections and improvements of the municipal discharges, which, after all, is something like -- I don't know exactly the correct number; perhaps Mr. Yantis or Joe Teller will tell you -- but I would say at least 50 percent of the discharge comes from the city of Houston.

Now we have felt that if we could get these people to tuck in their collar and go to work, it was a whole lot better than taking them to the courthouse. It costs a lot of money to go to the courthouse and we don't have any extra money, as I think you can know from my remarks awhile ago. If we can persuade them to correct it by peaceful means, I think we will accomplish it more economically, more surely and more rapidly. And overall, that has been our policy.

Now we will, if somebody just insits on making the heartache, try to accommodate them and we will ask the attorney general to take them on. In some cases we have.

One point I think we must consider most significant is the use of old data throughout the Federal report. I have earlier mentioned the hazard of using data which is not carefully developed. It seems to me that the use of 2, 3, and 4-year-old quality information in the report upon which this conference is based leaves much to be desired. I also do not think that saying the solution to this problem is to summarily diminish the load 90 or 95 percent will work.

Of course, I think that your actions will probably bring you on many cheers from Chambers of Commerce in other areas of Texas, who through the years have been losing population and industry money to the Houston area. I think that a great many of them would welcome the exodus of a great many people from Houston into their areas and a great many industries. But I don't know that I think that that is the best way to solve it, and it might cause a few chills to go down the spines of the people building all these new buildings around here that you see, because if your recommendations prevail and that is a solution to this problem, they are not going to be needing a whole lot of them. I would say that probably a great many people who have bought homes and have equity money in them, in the event of such an exodus, are going to have a great surge of folks coming in who want people to take up their notes, much less to give them the equity that they have got.

So, I just think your idea of solution to this thing is damn poor. We have got to find a better way. (Applause.) Now I think we had better address ourselves practically to how we can get onto it cooperatively and effectively in working together, rather than hiding behind bushes and jumping out and throwing a rock or taking a potshot every now and then. (Laughter.) I think that is also a damn poor way. We on this board aren't for it.

Now you have had a good many sampling teams that worked in this area for the past year, and surely they must have on hand at least some current information. Upon consultation, we would be glad to assist every way we can to update it and bring it up to date.

Now here awhile back, at the request of Mr. Vanderhoof -- and we welcomed it and were glad to have it -- our board assigned one of the most able men that we have and I think one of the best in Texas, or any other state of the United States, to spend a large part of his already-stretched time, working with your Agency on the Houston-Galveston problems -- Mr. Joe Teller -- so that we could have better cooperation, better understanding, and we could get rid of red tape and delays. Mr. Teller was working directly under the advice and authorization of this board.

Now I don't know what else better we could do. Now I do hear from Mr. Teller that he has some difficulty with the cooperation, because in reaching a mutual decision, most generally it entails accepting your folks' recommendation per se, without at least a compromise, or every now and then picking up something we say as might be worthwhile.

Dick Vanderhoof is a fine man. We are glad to have him in your organization down in Texas. He and I talk frequently on the phone, and I told Dick the other day: "Now dammit, I don't see much use in your people and our people getting up there arguing over whether it's 000.5 or 000.55 or 4 when it doesn't make all that difference. Now, for goodness sakes, you quit acting like kids and our people quit acting like kids on the schoolground and get together and work this thing out with some common sense."

I still adhere to the thought and so does my board that the best interests of the public in this State and in this Nation, whom we both serve, can be served and can be attended to better that way, rather than the procedures which have been filed. I'm sure that we have not always been perfect ourselves, and certainly we stand to accept in good faith and in good consideration suggestions you have. I had hoped, as I have so often hoped when I talked to Mr. Ruckelshaus, that we had arrived at that platueau. We would like to think that the new data that you people have apparently found down here would be made available to us for our use, as we have always made ours available to you.

As a matter of fact, I think I recall a time or two when Dick called me and said, "Now we don't have any way without getting a court order to get in these plants to look at them. I wonder if you would send some of your folks with us, because you do have that authority under law, so we can go in and take a look."

I don't recall any time I have ever refused. I hope Mr. Yantis and Mr. Teller have never refused to help in that regard. I would hope that we would be extended a like courtesy from y'all in exchange of data and information. I think the best interest of the people we work for would better be served.

Once again, the spirit of cooperation seems to be a 1-way street. It ought not to be either yours or ours.

To secure a total water quality management program in such an atmosphere is -- at the best -- very difficult if we are going to work the 1-way street procedure.

In brief summary, I feel that while the Environmental Protection Agency on the one hand is mouthing cooperation, on the other hand it seeks to embarrass and distract the very real and very earnest and very adequate efforts of the State agency to protect and improve water quality in the Houston-Galveston area.

From the State's viewpoint there yet might be a worthwhile result from this conference, if the Federal Agency wishes to approach the problems here on the basis of current facts -- on the basis of honesty -- on the basis of cooperation in the true sense between the State and Federal Governments -- and last, but by no means least, on the basis of leaving political axes to be ground in a more appropriate and less dangerous environment.

For yet one more time -- and on such bases -- the State of Texas is willing to try.

I thank you very much.

(Applause.)

CHAIRMAN STEIN: Thank you, Mr. Fulcher, for a very constructive statement.

Are there any comments or questions before we go on?

(No response.)

CHAIRMAN STEIN: I think we need some clarification here. However, I want to make one point first, because I don't want to wait to bring this out until after the State's full presentation.

Now, concerning the first point you made, I know that I have certainly in the past been to Texas on many, many occasions and I have always felt that the people you have had working in Texas were of the highest caliber. I have always felt that they had personal and professional integrity. I certainly don't think there is any question at all about that. As far as I am concerned, I don't think there is any question about the ability of your technical people.

The other point I believe you raised -- and I can understand the State's point of view on this -- is that you are asking, in a sense, what is Texas accused of? As I read the report, I don't think that Texas is accused of anything.

What we are here to deal with is the

discharges of municipalities and industries into the water which may or may not have caused problems. Texas isn't discharging these materials; the municipalities and industries within Texas are. That is what we are hearing and that is what we must deal with. That is the question.

Now there are several other points that I think are pertinent. Since you said, "Look at your record," I agree we should look at ours.

You raised a question about the economic impact on Houston. We have had many enforcement actions and we always take into account economic impact. I think our records will show that, as a result of these conferences and our programs, we have not had a deleterious effect upon the economy in any area of the country we have been in.

I believe that the whole purpose of the conference is to work out a compromise between the State and Federal Government, and I would say this advisedly: I have never run into a case yet where we were completely right, nor the State completely right nor industries and municipalities completely right. I think the most successful programs have been accomplished only after an amalgamation or fuzing of ideas and then working together.

One other point: I want to assure you that our data is available to the State now. We do have a problem which you alluded to before referring to that professor from Wisconsin who writes us a lot of letters too.

(Laughter.)

The point is that sometimes you get data you are not sure of and you have to check and recheck and check again. Data like that is not shared, not because we don't want to share the data but because we may not be sure of the data.

In the mercury cases which you mentioned, we have split samples with industries in the States, and we never had a problem concerning how much mercury was coming down. We were all in agreement on the physical facts.

Now, the last point I want to make before you complete your statements concerns the shellfish area closing.

As I understand the Federal report and Federal presentation, there were two aspects. One aspect is that significant areas of the Galveston Bay area are closed to shellfish harvesting now. If these closures are caused by source pollution, it could be subject to abatement under the Federal Act just because you have closures.

The other point is that the people who prepared the report may have thought these closures should be extended or be reevaluated. Now this may or may not be the case. But the essential thing, it seems to me, is the statement in the report that some areas are, in fact, closed and are deemed to be closed by the action of State officials and the approval of the Federal authorities.

MR. FULCHER: Well, Mr. Stein, I thank you for your kind remarks in regard to our staff and for your explanations. I just hope that this time your thought and your expressed aspirations carry on up the line in your organization.

Let me say to you that I don't believe your people need a buggy whip or a conference with all of the questionable data one way or another to get us to move in this State.

I do sometimes hit a blow now and then in my own personal business. I can ill afford to work full-time at $25.00 a day for the State, which I get.

But, generally speaking, I will give you my card, and if you call my office, either at the Water Quality Board or at the Texas Star, they will lay hands on me in 2 or 3 hours, and you don't need to send out a full scale battalion. Just call me and I will get them on the line.

CHAIRMAN STEIN: Thank you, Mr. Fulcher.

Just let me say that I may throw a rock or two occasionally myself but the way I am built I scarcely can hide behind a bush. (Laughter.)

MR. FULCHER: Well, I would have to join you on that. We will just have to get out in the open. There are not any bushes that big.

MR. QUARLES: I would like to respond, Mr. Fulcher, to your comments only very briefly at this time.

I think a little later in the day I would like to make a few comments of a more general nature on the objectives of the Environmental Protection Agency toward the general subject of enforcement of pollution laws around the country, and with specific reference to the situation in the Galveston Bay and the Houston Ship Channel.

At this time, I would like to repeat the expression of feeling that Mr. Stein has just made in welcoming the constructive nature of your comments, and assuring you that our concern with this problem is a concern with the pollution problem that exists here, and it is not a concern with trying to point out faults with the efforts of those who have been striving on an overtime basis to find improvements and make them in the existing condition.

We are here to bring an improvement in those efforts and to add our forces to those who are already working on the problems, and I hope that there will be a very bare minimum of focus on "who hit John" and why the problem is here, and the maximum focus on how we can go from where we are to where we want to be in improving the existing conditions.

So, we welcome your putting the focus on that part of the picture, and we hope to work together with you in a manner that you just stated.

MR. FULCHER: Thank you, sir.

Anything else?

CHAIRMAN STEIN: Any more comments? (No response.) Thank you very much.

MR. FULCHER: Thank you, sir.

MR. YANTIS: Mr. Stein, we will continue with the State presentation.

I am going to take the next speaker out of order if Mr. Josiah Wheat is ready. I think it will be all right if Mr. Josiah Wheat addresses the group at this time.

Is Mr. Wheat here?

MR. WHEAT: Right.

MR. YANTIS: Mr. Josiah Wheat is an attorney here and is especially interested in this forum.

He was appointed by the United States, Mr. Nixon, as a member of the National Water Commission. He is a Presidential appointee within the State. He is the immediate Past President of the State Bar of Texas. He is the Chairman of the Board of the Texas Water Conservation Association, which is one of the most effective conservation groups especially on water conservation within the State. He is a member of the American Bar Association Special Committee on Environmental Law. He is the President of the Deep East Texas Development Council. He does have many other honors, and he has worked in the field of water resources and water conservation and good government for many, many years.

So, I introduce to you now, Mr. Josiah Wheat, speaking I presume not as a member of the National Water Commission appointed by the President but in his private capacity.

MR. JOSIAH WHEAT
ATTORNEY-AT-LAW
WOODVILLE, TEXAS

MR. WHEAT: Thank you.

After an introduction like that, I feel indecent remaining in an upright position rather than laying prone with a lily across my chest. But, thank you just the same.

Before I comment, I would like to here publicly, if you please, express the appreciation of the Texas Water Conservation Association to Congressman Bob Eckhardt for his assistance in preparing this, and Mr. Quarles for your very kind consideration accorded our plan for matching funds known as the Texas Compact, which was prepared and submitted by the River Authority Panel of the Texas Water Conservation Association.

Both of these gentlemen we are certainly indebted to.

After the Chairman's remarks just now, my purpose for being here is probably redundant, but, I did ask for time to come here today simply as one private citizen who has been concerned for more than a decade with our State's continuing water quality enhancement efforts.

Unfortunately, I don't have any clients on the Houston Ship Channel, and I don't represent the Texas Water Quality Board. However, I am one of those who supported the creation of that board some years ago and I am familiar with what the board has been doing and been trying to do in these intervening years.

In recent years I have had the opportunity in one capacity or another to travel around this country and see what other States are doing in this area. I have come to the firm conclusion that the Texas water quality program is far ahead of any other State in this Nation and that the experience and expertise of its staff is second to no State or Federal Agency in this country.

Certainly, its experience exceeds that of any such agency, for, in spite of what may have been said here and elsewhere, the Texas water quality program has been moving forward and moving effectively. And I think it is time someone pointed that out.

Unfortunately, there are some persons with closed minds who enjoy going about the country and persisting in the statement that the Water Quality Board is not doing anything.

It becomes sort of the thing to go around and make that statement, and if it is accompanied by a mournful rolling of the eyes when the statement is made, it puts you higher up in that particular group.

These folks will simply not stand still long enough to learn what is being done through the efforts of the Texas Water Quality Board. And, also unfortunately, there are people who should know better who accept these untrue, unsubstantiated statements without question and repeat them as gospel. I simply want to say to you today what I believe everyone who has been in position to study these matters knows -- that while our program here in Texas may not be good enough, it is far superior to any other program anywhere else; and if you know of any State which is doing more or doing it better, I hope you will please point it out to us, and we will see that it is duplicated here in the State of Texas.

In the meantime, we need your help and your cooperation in doing the job we started here in Texas at a time when water quality programs were still just an idea in most of the rest of the United States.

When we consider such facts as that -- here in texas -- we have required secondary municipal treatment since the 1920's or 1930's .... that we have had a formal water quality enhancement program in effect since 1961, and less formal for many more years .... when we consider all that has been achieved here in contrast to some of the things that are still going to be permitted in other parts of the country .... when we consider that this hearing and all the attendant publicity results from our mutual concern over the discharge of 291-1/2 tons of suspended solids at a time when 67,000 tons of mine tailings are still being discharged every day into Lake Superior -- a practice which never would have been allowed here -- then I think that we must conclude that, while the Texas Water Quality Board may not as yet have been able to do everything we would all desire, it must be doing something right.

With your help it could do a whole lot more.

Certainly, it seems to me we have no time, at this late date, for an adversary proceeding between your Agency and the Texas Water Quality Board. I hope that, as a result of your visit here, we will see help forthcoming, together with the joint cooperative effort which is so essential to the attainment of the common goal of clean water for all America and that in abundance.

Thank you very much. (Applause.)

CHAIRMAN STEIN: Thank you, Mr. Wheat.

MR. YANTIS: According to the agenda today I will read my remarks, and then we will have a rather lengthy series of presentations. I would like to tell you approximately how the day will go and I do believe it will take all day.

There will be a statement following mine by the Texas State Department of Health. Then one by the Texas Parks and Wildlife Department, and two statements by engineers from the Texas Water Quality Board. Then a presentation by the Gulf Coast Waste Disposal Authority, and a presentation or statement by the Houston-Galveston Area Council, and a brief statement by Cecil Reid of the Sportsmen's Club of Texas. There will be fairly lengthy presentations by something like 20 different industries. At the conclusion of the day, depending upon what has been said up to that point, I will make a concluding statement for the State, and summarize.

I do have one question. How many of you -- and I would like a show of hands -- before we start off -- would like to take a 15 minute-or-so coffee break? Well, since the answer is yes, we will start back at 10 minutes to 11:00. That is 20 minutes.

(Whereupon, a short recess was taken.)

MR. YANTIS: May we have your attention, please. I am going to return the Chairmanship back to Mr. Murray Stein for a moment.

CHAIRMAN STEIN: Let's reconvene.

Mr. John Quarles, the General Counsel of the United States Environmental Protection Agency and its Assistant Administrator for Enforcement would like to make a statement at this time.

Mr. Quarles?

MR. JOHN R. QUARLES, JR.
ASSISTANT ADMINISTRATOR FOR ENFORCEMENT
AND GENERAL COUNSEL
ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D. C.

MR. QUARLES: Thank you, Mr. Stein.

If I may, I would like to talk to this group of people here in the room today on perhaps a more general level, to express some of the concerns of the Environmental Protection Agency, as we look at this problem involving the Houston Ship Channel, and as we from Washington look at the environmental problems -- in particular, the water pollution problems that lie in front of us around the country.

In his comments this morning, Mr. Gordon Fulcher struck, we felt, a most encouraging attitude as to the prospect of moving forward to clean up the pollution that exists here. He also expressed his concern over the connotations or implications of criticism which were contained, or may have been interpreted as being contained, in the report delivered to this assembly yesterday on behalf of the Environmental Protection Agency.

I would like to repeat the comments that I briefly expressed following his statement -- that we are not here in any sense of finding criticism or finding fault. We do not -- and I would like to emphasize -- we do not feel that there has been any blanket failure to function on behalf of the Texas Water Quality Board.

We do not have that feeling toward any other State's water control agency.

I think to step back from the immediate

problem can provide a healthy perspective to us as we look at this situation. To the extent to which it concerns us, it is essential for us to keep actively in the forefront of our findings.

Environmental protection has been in a state of extreme upsurge during the last year or 18 months. I recall personally just a little less than 2 years ago, when I began working as a representative from the Department of the Interior on the Task Force trying to develop the environmental message which President Nixon sent to Congress in February of 1970, we were concerned at that time that there might not be a particularly active reception of that message by the Congress and by the general public.

The reason for our concern at that time was that we knew that the President intended to propose some rather far-reaching programs and other proposals for environmental protection, and we were not sure that the country stood ready to receive those proposals.

By the time those proposals in fact were delivered, there had been such a dramatic shift in the attitude of the general public and of the Congress that we felt at something of a loss to account for our earlier apprehensions on that subject.

During the past year, it has been practically impossible to pick up any newspaper, or any magazine, or to watch the evening television news without seeing some reference to a subject of environmental protection.

This has become the hottest issue in America in domestic concerns in the last year, and everyone has been fully alerted to the problem, and a vastly increased number of citizens are actively trying to do something about it.

Our country is making, or has made, a decision regarding the subject of environment protection. The decision is that we must do more. The details of that decision, the implementation of that general policy, are something that is now in the process of being developed and applied. But the sense of concern, the willingness to make a commitment, has arisen all of a sudden.

In the course of this rapid arousal of public concern, the general public, conservationists, the League of Women Voters, Isaac Walton League; you name it -- all manner of citizen organizations and individual citizens -- have looked with great alarm at the conditions which they find to exist in America today, and they have said, "We must do something about it."

The concern which I have, as an individual out of my own personal background and out of my own governmental experience, is that there may well be a loss of effectiveness in trying to achieve the goals which we are concerned with achieving. This might well result from an overemphasis on the negative posture of those who have been in charge.

It is all too easy for citizens who are themselves newcomers to the problem -- and I too am a newcomer to the problem -- to point to industry and say, "You have done nothing, or to point to State agencies and say, "You have done nothing." The fact is that many, many industries have recognized the problems created by the discharges long ago and have adopted programs which at the time of their adoption may have represented an extremely high degree of commitment to protect society against pollution. We lose sight of this foresight and this achievement in the light of today's increased standards.

Similarly, there is a tendency to look at the officials of government who have been in charge to say, "You have defaulted on your responsibility." The fact is that we live in a democracy, and in a democracy it is the people's will which sets the general level of intensity for whatever efforts you are talking about -- whether they are efforts to cut crime in the streets, or improve health, the war on cancer, or environmental protection.

What the general public wants to have happen will within a general range come to pass, and I don't believe that anyone fairly can lay the fault for the neglect of our environmental values anywhere. other than with society as a whole.

And last of all, should that fault be directed at those few people who have been in the State or the Federal programs working for years to educate other people to the need to take these problems more seriously which, as a general society, we have just recently come to fully appreciate?

What I am attempting to say is that I personally, and Bill Ruckelshaus, and all of us at the Environmental Protection Agency, are not looking at either the State government or others involved in an accusatory way. What we are saying is that we want to look now at where we are, and where we should move from where we are. And to the many members of the Environmental Protection Agency who are also in the room, whom I may not have had a chance to speak with personally, I would also say that I don't have any fault with your efforts. But our Agency must also improve and strengthen its efforts as we move down the road.

I would like to talk briefly about the Federal goal of the Environmental Protection Agency in dealing with these problems.

The Federal Water Pollution Control Act establishes a pattern of partnership with the Federal Government and the States in dealing with these problems. It is not our privilege under that law to displace State action on these problems. The majority of manpower presently working on these problems around the country is in the State government if you compare the State and Federal Governments.

We have a role to play and the State has a role to play, and we have no thought of trying to take over the role of the State.

In meeting our own responsibilities for research, for technical work, or funding, or enforcement, we have a very big job to do. It is plenty big for us to do our job without trying to take on the jobs that other people have to do.

With regard to the Federal-State water quality standards and other standards that exist, under Federal law we have a responsibility to take action to make sure that those standards are enforced. We intend to discharge our responsibility in a manner which provides adequate opportunities for others -- State officials, industries, conservationists, the press, and general public -- to give us the benefit of their opinion as to how we should discharge our responsibilities.

In the end, the rule that I think always applies to any public official is that he must ultimately let his own conscience be his guide and do what he feels is proper to discharge the responsibilities which he assumed in taking an oath of office, or otherwise taking the position that he holds.

The enforcement conference in which we are now engaged is a mechanism which has been tried and tested and which has demonstrated, in a wide number of locations around the country, a very considerable potential for improving efforts to control water pollution.

This is the 53d Water Pollution Control Enforcement Conference held under the Federal Water Pollution Control Act.

In the other 52 conferences we have a record of substantial achievement. Wherever the best progress has been achieved it has resulted from a very close working relationship between the Federal officials, State officials, conservationists, industries, and municipalities.

The problem is too big, too complex, too filled with technical uncertainties for us to really achieve the best results if we are devoting a substantial part of our effort to quarreling among ourselves. All who are concerned must join together, perhaps, with varying slants on the problem but nonetheless united, in the ultimate-shared objectives of cleaning up the water.

In the presentation which was made on behalf of the Environmental Protection Agency yesterday, a very large number of statements were made as to the degraded condition of water in Galveston Bay and related bays and the Houston Ship Channel. Some of the details of the data which we have and the facts which we presented may not be entirely accurate.

I was asked by Gordon Fulcher and Hugh Yantis when I came down here -- and we met Sunday evening to discuss the general situation -- if I would be kind enough to listen to their presentation, as well as the Federal presentation, and to keep an open mind. I gave them my assurance that I would do that. I hope that all of you are also approaching the subject with an open mind in the manner requested initially by the Chairman, Murray Stein, in his very first opening remarks.

We are not clear on all the details. But I think there is a salient fact that emerges and which I expect will remain clear when all the dust settles on this conference. That is, there is a high degree of pollution in Galveston Bay and the Houston Ship Channel, and the pollution which exists requires an increased level of effort to control that pollution -- more treatment facilities by the municipalities, more attention to the pollution problems by the industries, more establishment of requirements of treatments, and deadlines within which those requirements are to be met.

Our objective in entering this enforcement conference is to not engage in a prolonged series of studies but to develop a plan of action to meet the problem. I was asked yesterday whether this report would be just simply another report. I responded that I doubted very much if this report would be just another report; that we regarded this report as something which would trigger a new and increased level of efforts to curb the pollution that now exists.

In approaching the problem today, tomorrow, over the next weeks, over the next months, perhaps over the next years, I have asked representatives of the Environmental Protection Agency to be reasonable, to be cooperative, to try to see both sides of the picture if they are committed to one side. I have confidence that they will proceed in that manner to a very considerable extent.

In looking at the problems that we have, I think I have made it clear that when we talk about establishing a plan of action -- I am not saying that there has never been a plan of action -- what I am saying is that in this situation, as in many other comparable situations around the country, the level of attention given to these problems, as we look at the problem now, must be judged as not adequate. We all must join together to intensify our efforts to solve these problems and to establish more stringent, higher levels of treatments.

The concern is often expressed that people must make a choice between payroll and clean water. It doesn't come to that sort of a choice. Both can be obtained. We need electrical power. We need the other products of a strong and vigorous economy, and this Administration is fully aware of these needs, as I have pointed out to many industrial representatives. We are aware of these needs not only in the White House and the Commerce Department but we are aware of them in the Environmental Protection Agency.

However, we are also concerned to cut down on pollution, and both objectives can be achieved by adequate planning and adequate efforts to achieve both. There is no reason at all that a much more vigorous attack on the pollution problems at Galveston Bay cannot be carried out together with a continued healthy growth of the businesses located in the Houston area. And we would certainly bend all of our efforts toward achieving precisely that result.

The Environmental Protection Agency is an enforcement agency. The President has so charged it and the Administrator, William Ruckelshaus, has on recommendations, enunciated this as our primary mission.

We are in business to achieve results. We are not going to look at a problem and go away and leave it. We are interested in each of the efforts that we undertake and committed to stay with that problem until visible, acceptable results are achieved -- whether that takes 1 year, 5 years or a decade.

So, I would assure all in this audience that we will be in this arena until the conditions that caused us to come here have been abated. But we will be in this arena to work in a constructive, cooperative way not only with the Texas Water Quality Board but with all of you who are here concerned with improving our environmental protection, as a means to approaching a higher quality of life for all of us, both here locally and also in the country at large.

I hope that that spirit which was so well expressed by Gordon Fulcher a little earlier and which I have tried essentially to simply repeat in my comments, will govern everyone as we continue to work together on these problems.

Now that ends my comments, but I look forward, Mr. Yantis, to hearing all that you and your representatives will present. I am sure that you can present a great deal that will throw helpful, additional light on the subject and that through the combined presentations here today. We will get a better picture of where we stand and be able then to come to some conclusions as to where we should proceed.

I thank you. (Applause.)

CHAIRMAN STEIN: Thank you, Mr. Quarles.

Before turning this back to Mr. Yantis, I would like to indicate that today we are thinking in terms of recessing for lunch at 12:00 and reconvening at 2:00. We are not usually that indulgent. But I think the pattern and the spirit of the conference is beginning to emerge, and I hope that all the participants and other people can get together and possibly use that time to caucus and rethink their presentations if they think that is appropriate.

Mr. Yantis, will you go on?

MR. HUGH C. YANTIS, JR.
EXECUTIVE DIRECTOR
TEXAS WATER QUALITY BOARD
AUSTIN, TEXAS

MR. YANTIS: Mr. Quarles, I certainly appreciate your comments.

H. C. Yantis

I find myself wishing that with the proper technical education, you could fill all of the positions in the EPA. I think we would then have no problems. (Laughter.)

As much as I appreciate your comments, I will read my own as they were originally drafted. They were written with the recognition that there were problems in the past, and I think they are still appropriate, though I hope that some comments in it are now wrong.

Gentlemen: The Chairman of the Texas Water Quality Board has already -- may I digress? I rarely read a paper. I prefer to speak as Mr. Quarles, but we were asked to write them down and I did so. I think it is duller this way, but that is the rule of the game. So, if you will bear with me, I will read it as I wrote it.

The Chairman of the Texas Water Quality Board -- I would digress at this point and talk about the Galveston Bay Study, though. You will hear about it later.

Why on earth would we have spent $1-1/2

million if it were not to make a plan of action? If it is going to cost this much and take this long to make it, it ought to be worth waiting for and be worth using. Yet the implication is that we should stop thinking and start working. That is like building a building without a foundation.

The Chairman of the Texas Water Quality Board has already addressed you and has drawn your attention to certain deficiencies in the cooperation offered by the Environmental Protection Agency in this matter to the State of Texas, its agencies, and its people. There is no need for me to restate the Chairman's views which are my own. I do, however, feel most strongly that in introducing the presentation on behalf of the State of Texas, and especially as I introduce testimony and evidence on the many accomplishments under the Texas program that I am not addressing the Chairman of this conference, but rather I am addressing the people of the Galveston Bay-Houston Ship Channel area. The Environmental Protection Agency has had access to knowledge about the accomplishments under the Texas program. It appears that you have simply chosen to ignore it. The people of the area, on the other hand, may be hearing for the first time of these accomplishments and I, therefore, believe that it is they, not the EPA, who need this information.

As I read through the black paper, which you have used as the basis for this hearing, I have been struck by the fact that the cost of producing the report is undoubtedly far in excess of the value of the shellfish which are supposed to be the subject of this conference. (Laughter.) I note that having touched lightly upon shellfish that you have then ranged far afield from matters relating to shellfish, but this was undoubtedly your intention when the conference was called.

I again note in reviewing the black paper that there are many errors of one kind or another in it, and I do not criticize the report for these errors. I do, however, strongly call to your attention that many of these errors, because some of them relate to information from my own agency, could have been noted and corrected had there been a partnership in the preparation of the report.

You are aware, I know, and the public should be aware, that we have had the report for only a short time and it has not been possible to scrutinize every entry or every comment. Necessarily, our presentation and those of the State agencies, industries and others who will participate in our presentation do not make a point-by-point analysis of the report, but rather we will present to you what the facts and the values in the matter appear to us to be.

If I could at this time and before the conference has been concluded make a recommendation, as you have made recommendations in the report prior to the conclusion of the conference, it would be that the conference be adjourned and that your technical personnel and ours spend the time requisite to a true evaluation of the facts and all of the values and all of the accomplishments that are involved in the matter under discussion.

Nevertheless, we are today holding a conference, or in other words a public hearing. There is the implication in the call of this conference by the Federal Government that the facts would otherwise never be known -- that EPA and the Texas Water Quality Board would otherwise never communicate and that the people of Texas would otherwise have no forum in which to address their governments, be they Federal, State or local. This, of course, is not the case. Most strongly, it is not the case. Every action of the Texas Water Quality Board is taken in public, after public deliberation, and the records of the Texas Water Quality Board are public.

Monthly, the members of the Texas Water Quality Board gather for 2 days in public to take care of the business of the agency as it concerns them directly. Any member of the public can address the Board in person on any subject relating to the work of the agency, and many persons have taken advantage of the opportunity. In addition, the attorneys of the agency, with technical assistance, hold hundreds of public hearings every year and the people of Texas are welcome to attend these hearings and to participate in them.

Even the water quality standards for the

Houston Ship Channel, which were attacked yesterday, were developed after a series of public hearings, beginning I believe in 1964, before the Federal Government adopted a similar standards-setting procedure. We do not claim now, and would not then, that the standards were above correction and improvement. But I would not negate these countless hours spent by many dedicated men and women from many agencies who devised them.

It is a tragedy to relate that the public hearing held in Houston in late 1966 or early 1967 to present the standards finally to the public was attended by no member of government at the local level. No elected official nor any employed representative of any town, district, county or other local government attended.

I believe only three ladies represented the general public and none of them would speak until I went into the audience and took one of them by the arm and led her to the front of the room. I believe she is here today and will remember that occasion.

But I digress.

How much better would it have been had the information in the black paper and the evaluations of it been developed step by step with full participation by all concerned?

But no. It sprang full grown like Venus from the brow of Jupiter.

Sunday night as I approached this city by car I heard a newscast about this meeting. It was on a tape recorder. Your spokesman reported that the conference was called as a result of complaints reaching EPA. I do not recall having discussed complaints worthy of a conference of this kind with EPA. I trust they will be made a part of the record. The actions which this conference will take were also set forth. This is disturbing as the conference had not even been held.

In examining the black paper your attention is drawn to the fact that in January of 1970, the Department of the Interior, with most of the same facts or alleged facts at its disposal, determined after an abortive attempt to attack the State of Texas and its programs, that there was then no basis for a shellfish enforcement conference relating to the Galveston Bay system. That report undoubtedly still exists, although it has never been made available to the State of Texas, but it is difficult to understand how events could have changed so markedly as to now require an enforcement conference. I might also take note of both the good and the bad in the March 12, 1970, report of the Water Pollution Control Advisory Board to the Secretary of the Interior, who represented then the President of the United States as the Environmental Protection Agency does now, and it is the same President. In that report the State was commended at the activiation of the Gulf Coast Waste Disposal Authority and that Authority will speak to you in a few moments. I mean the Presidential Advisory Board.

I am glad to report that that paragraph is obsolete on the basis of the intervention yesterday of Mr. Quarles.

We have signed some contracts for the Galveston Bay Study, and I believe we will have a breakthrough and begin to have that Study proceed more vigorously.

The Board expressed pleasure in its report on the "aggressive approach to attainment of the goals of clean water for Texas, and for Galveston Bay, an incomparable national asset which must be restored and preserved."

The Federal Board stated that it was "impressed with the sincerity of the concern about absolute necessity for water improvements, expressed by State and local officials and by individual citizens and industrial leaders."

As this hearing is intended to concern itself with shellfish, I quote here an entire paragraph: "The (Federal) Board is concerned with possible extension of pollution of the oyster beds in Galveston Bay with the consequent danger to health and loss of income to the shellfish industry. Efforts to obtain information on any recent closing of oyster beds due to pollution evoked testimony that approved areas have been expanded. Fifty percent of 250 square miles in Galveston Bay is now closed to shellfish harvesting. Upper Trinity Bay was reported as having always been closed to oystering due to pollution from land runoff.

There are no oyster beds in this area, which has traditionally been heavily silted."

The report continues with the comment: "Of the 5,681 acres of oyster reef contained in the bay, 842 acres are permanently closed to the harvest of shellfish because of pollution, 313 acres are classified as conditionally approved. In addition, there are over 2,000 acres of private oyster leases on State land for oyster beds, and many oysters have been moved from the polluted areas to these, under State supervision.

"It is important that Trinity Bay be cleaned up to insure future oyster and fisheries development."

It is humorous to note that out of this report Resolution No. 3 relating to the Federal Government's delay in funding its share of the Galveston Bay Study finds us still seeking to obtain these funds, even though there is now a contract between the State and the Federal Government by which the funds should be released.

I will not quote further from the report of the Water Pollution Control Advisory Board. I have already asked Mr. Joe Wheat to make his remarks, so I will skip this portion. There will then be a representative of the Texas State Department of Health. I do not believe they wish to speak, but they are here and I think you should know the Governor of Texas is as interested in this hearing as anyone else.

The Gulf Coast Waste Disposal Authority will address you after the State agencies from Austin have reported.

Mr. Jim Quigley is in the audience and is now a person in private enterprise. He was then the Commissioner of the Federal Water Pollution Control Administration who helped bring about, jointly between the Legislature and Governor John Connally, the creation of the Gulf Coast Waste Disposal Authority.

There will then be a presentation by the Chamber of Commerce, and under Mr. Quarles' leadership, as I say, I believe we have it made now.

Following the Chamber of Commerce, those industries that have been specifically named in the report as major contributors to pollution to the system have been invited by the Texas Water Quality Board to present their views and their information.

As I introduce the Texas presentation, please keep in mind that the Texas Water Pollution Control Board was organized in 1961, almost exactly 10 years ago. There had, however, been for a number of years within the various agencies of the State, and in many cases within local governments, as here in Harris County, effective programs in the field of waste treatment and water pollution control. For 10 years, the State of Texas has used waste control orders or permits as an effective tool for the control of pollution.

Up until the past several months, the Federal Government decried the use of a permit system for the control of waste discharges, but now at long last has learned what the State of Texas has known for 10 years -- that an individually issued permit system is an effective tool in water pollution control administration.

In 1965 -- actually, we began in 1964 --

the State of Texas began setting water quality standards for the streams of the State before the Federal Government began its activity in this field. We began, I might add, with the Houston Ship Channel.

We began nearly 4 years ago a Galveston Bay Study because we recognized the deficiencies in our knowledge of the system. The Federal Government has not yet significantly funded this study, although we continue to hope that it will.

Yet you now, through the black paper, comment on the need for more knowledge about the system. Also in almost every session of the Legislature since 1961, there has been an improvement in the various statutes under which the Water Quality Board, to use its new name, carries out its functions. The black paper hardly takes note of this fact.

Now, please listen carefully to the following figures. The first appropriation to the Water Quality Board for the year ending August 31, 1968, was a little over $1 million to which was added $2 million for regional planning studies. Remember, we became a separate agency September 1, 1967, with no employees and no budget, and, only about $200,000 of this appropriation came from Federal funds. Yet there was comment about the Texas deficiency about which we will speak later.

For the year ending August 31, 1969, the appropriation was a little over $1,750,000 with only $400,000 coming from Federal sources. For the year ending August 31, 1970, the appropriation was a little over $2.1 million and the amount for the year ending August 31, 1971, was slightly larger, with only $400,000 each year coming from Federal sources. We are right now at about a $2 million a year level.

We are just beginning a new biennium, or we will on September 1, 1971. The appropriation for these years with the Federal funds estimated to continue at about $400,000 each year is about $4.5 million each year. That is for program only and has nothing to do with the building of new sewage treatment plants. Our appropriations will be $4.5 million each year. That is more than double. You cannot, in the face of these appropriations by the Legislature of the State of Texas, fail to acknowledge that this State is working very hard to meet its responsibility in the field of water quality not only in the Galveston Bay area but throughout all of the State.

Now, the first presentation -- and I had planned that Mr. Teller would make these introductions, but he prefers that we do so.

(Off-the-record discussion.)

MR. YANTIS: We will have to break at 12:00, as was announced, even if this presentation is not finished. But there are so many to be heard I don't believe we can afford to break early.

From the Texas State Department of Health, which provides one member of the Texas Water Quality Board -- and I might say here that there was a comment yesterday about the membership of the Texas Water Quality Board and the comment was totally in error -- the board is not organized as you were told. It never has been.

The Texas Water Quality Board has 4 members who are representatives of State agencies. One State agency is the Commissioner of Health. That is the State

Health Department. Then there are the Parks and Wildlife Department, the Texas Water Conservation Board and the Railroad Commission. There are 3 members appointed by the Governor to represent the general public.

The State Health Department has a member of the Texas Water Quality Board in the person of Dr. Dudley Johnson, who will make a statement in the general field of shellfish sanitation.

Following Dr. Johnson, Dr. Carl Oppenheimer of the Texas Institute of Marine Sciences will make a presentation related rather closely to the Texas Department of Public Health.

Dr. Dudley Johnson.

DR. DUDLEY JOHNSON
DIRECTOR OF THE MARINE RESOURCES
TEXAS STATE DEPARTMENT OF HEALTH
AUSTIN, TEXAS

DR. JOHNSON: Mr. Chairman, conferees, ladies and gentlemen. I am Dudley Johnson, Director of the Marine Resources, Texas State Department of Health.

[Dr. Johnson's statement in its entirety follows.]

ENFORCEMENT CONFERENCE
ON POLLUTION AFFECTING SHELLFISH HARVESTING
GALVESTON BAY, TEXAS

COMMENTS BY
DUDLEY J. JOHNSON, DIRECTOR MARINE RESOURCES
TEXAS STATE DEPARTMENT OF HEALTH

In Texas, the State Department of Health is the agency responsible for the classification of oyster producing waters. This classification is done in accordance with the requirements of the National Shellfish Sanitation Program and should not be considered a water quality control program, as was pointed out yesterday. We were somewhat surprised to note that the Environmental Protection Agency's Report devotes a great deal of space to criticizing the oyster water classifications assigned to Galveston Bay by the Texas State Department of Health. In fact it states that if sampling were regularly conducted under the most unfavorable hydrographic and pollution conditions, nearly all of Galveston Bay would be closed to shellfish harvesting due to excessive bacterial pollution. We cannot agree with this conclusion. The Texas State Department of Health data indicates that the present classification of Galveston Bay is, in fact, correct.

As we studied the report it became apparent that the sampling data used by the Environmental Protection Agency to develop their criticism was not the same data that is used by the agencies responsible for the classification. The lack of understanding of the National Shellfish Sanitation Program and the Texas program in particular is perhaps responsible for what appears to be an unjustified criticism of a program that is not engaged in water pollution abatement control activities.

The Texas State Department of Health has participated in the National Shellfish Sanitation Program for many years. In 1965, the Texas Legislature passed the Texas Shellfish Sanitation Law which strengthened the Texas program and specifically gives the Texas Commissioner of Health the responsibility of classifying Texas waters as to their suitability to produce safe, edible shellfish. Due to the terminology of this law those waters that are found unsuitable for the harvesting of safe shellfish must be classified as polluted. The use of this term for classification purposes means, an area which is continuously or intermittently subject to the discharge of sewage or other wastes, or to the presence of coliform organisms in quantities likely to indicate that shellfish taken therefrom are unfit for human consumption. Let's be more specific, the use of this term by the Texas State Department of Health does not necessarily mean that waters so classified are not satisfactory for other purposes. It is not the Department's function to classify for other purposes, only to apply the National Shellfish Sanitation Program standards to the shellfish producing waters of the State and to indicate whether or not they comply with the standards.

In order to establish a better picture as to the status of the Texas Shellfish Program, we point out the following facts:

Texas has participated in the National Program for many years and we have never had a case of disease traceable to the consumption of Texas oysters taken from the approved harvesting areas.

The National Shellfish Sanitation Program is a rather unique program in that it involves three groups:

The State's program consists of the

necessity to provide laws and regulations for sanitary control of shellfish industry; the making of sanitary and bacteriological surveys of growing areas; responsibility for inspecting processing plants; and issuing numbered certificates to shellfish dealers who comply with sanitary standards.

The Federal program deals with the responsibility to make annual review of State's control program; responsibility to endorse or withhold endorsement of the State's programs; and the endorsement allows the sale of shellfish into interstate commerce.

The third portion of the responsibility is that of the shellfish industry. It cooperates in obtaining shellfish from approved harvesting areas; it provides plants that meet standards and it provides proper labeling of each package of shellfish with the certification number and other necessary data.

One of the very important points is that all State Shellfish Programs are annually evaluated by an Agency of the Federal Government -- The Department of Health, Education and Welfare -- is the responsible Agency, and conducts regular evaluations through its

Food and Drug Administration. The classification of shellfish growing waters seems to us to be clearly a public health matter, not one of water quality control.

In order for a State to qualify to sell its oysters in interstate commerce it must receive an evaluation of at least 80. The Texas program has received overall grades in excess of this figure and an examination of the grades for the past 6 or 7 years indicates a very good program. As far as we can determine Texas has never experienced any difficulty in marketing shellfish in interstate commerce. Our program complies with the National Standards and this is reflected by the fact that our product is readily accepted throughout the United States.

The Texas State Department of Health feels that in order to properly evaluate our shellfish producing areas, it is necessary to have specific knowledge of the area and considerable data covering a period of time sufficient to represent all kinds of conditions. It is obvious that data selected for short periods of time for limited areas can hardly show a complete picture. The sampling data collected by the Texas State Department of Health covers a period of time from 1963 to date and is from some 83 sampling stations, the location of the stations were established for the sole purpose of furnishing the best possible public health information as it relates to shellfish. In order to obtain this information, it has been necessary to maintain a full-time sampling crew in the area and to make more or less continuous surveys.

I will not bore you at this time with an in-depth discussion of the technical aspects of the classification of Galveston Bay. I would like to point out that this is a complex subject and would perhaps best be pursued in an atmosphere more conducive to the study of technical data. Our information is available at any time to qualified persons and, of course, has been examined regularly by representatives of the Food and Drug Administration. As far as we can determine the Environmental Protection Agency apparently has not availed themselves of this opportunity. We welcome the input of all qualified agencies and individuals that can contribute useful information bearing on the classification of Texas waters. In fact, in addition to the data collected by our staff, we review data collected by many other agencies such as the Parks and Wildlife Department, Texas Water Quality Board, The Marine Institute of the University of Texas, the Water Hygiene Laboratory of Dauphin Island, Alabama and many others.

The National Shellfish Sanitation Program's Bacteriological Standards for growing waters are: For approved growing areas: Coliform median MPN of the water does not exceed 70 per 100 milliliters, and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 milliliters for a 5-tube decimal dilution test. (These limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard.)

[Slide presented.]

Conditionally approved growing areas: Same as approved (quality of area may be affected sporadically.)

Thirdly, market shellfish at wholesale level: "Fecal coliform density of not more than 230 MPN per 100 grams and a plate count of not more than 500,000 per gram will be accepted without question."

Apparently EPA has applied these standards to bacteriological data gathered by the Galveston Bay Study and only then for a short selected period of time (December 1968 to April 1969 and December 1969 to April 1970).

The Galveston Bay Study is a well-designed program which will, I feel, furnish information that will be useful in the pollution abatement program now being conducted by the Texas Water Quality Board. However, this study was not designed to gather information for shellfish growing area classification. For instance, sampling stations used by this study which are in or adjacent to the present approved shellfish harvesting area are only 11 in number. While the Texas State Department of Health classification sampling stations are 40 in number for the same area.

Collection, handling and storage techniques are vitally important when sampling for classification purposes. You must take extreme care not to contaminate the sample during collection or prior to delivery to the laboratory. Obviously, all samples must be properly refrigerated and analysis procedures started as soon after collection as possible. The Health Department sampling crew follows a rigid set of instructions in this regard. The utmost care is taken during collection. All samples are immediately refrigerated and there is very little lapsed time between collection and preparation for analysis, approximately six hours being the maximum. It is important to have as much information as possible about the quality of water lying over the producing reefs. As an indication of trends, flood conditions, pollution transportation time, and bacteriological die off, sampling stations in the unapproved or polluted areas are also important. But the important factor is how good is the water from which we take our oysters. This can be indicated by bacteriological water samples but perhaps the best indicator would be the quality of the oysters themselves.

If the Texas State Department of Health is to make oyster water classifications, we feel we must rely on our data. As I have said before we are not in the pollution abatement business. Our major responsibility is in the public health aspects of the oyster growing areas and of the oysters consumed by the public.

[Slide presented.]

In Exhibit 7, you will note that the approved area is separated from the points of dense population by a closed area or buffer zone. It is also interesting to note that from the Houston Ship Channel Turning Basin to the nearest point of approved oyster harvesting area is 30-plus miles.

[Slide presented.]

To illustrate our point we have prepared an exhibit which we feel will show that the classifications based on Texas State Department of Health data is correct.

Exhibit 8A illustrates by the means of dots bacteriological sampling stations which meet all the National Shellfish Sanitation Program standards. As you can see, these stations which represent satisfactory oyster harvesting water are numerous and are located in both the approved and the unapproved areas.

[Slide presented.]

Exhibit 8B indicates, in addition to satisfactory stations, those that exceed the 10 percent rule of standards. This means that the stations represented by the green dots had coliform medians of less than 70 per 100 milliliters (which is acceptable) but that 10 percent of the samples from these stations exceeded a bacteriological density of 230 coliform per 100 milliliters. As you can see, these are pretty much scattered throughout the area you would expect to find them in.

[Slide presented.]

Exhibit 8C shows in red dots the location of sampling stations that exceed both the median coliform criteria and the 10 percent rule exceeding 230/100 milliliters rule. These stations are located about where you would expect them to be, we feel.

We feel that these exhibits prove our point that the bay has indeed been classified correctly. There can be no better evidence as to the proper classification than the fact that the oysters harvested from the reefs and analyzed for bacteriological content have all been well within the standards set by the National Shellfish Sanitation Program for market oysters. As you can see from Exhibits 9 and 10 all samples are well within the prescribed limits.

The red line represents the maximum limits available.

It is also interesting to

note that during a period in February and March of 1969 when the bay was closed to the harvesting of oysters due to a short but violent storm, the oyster meat samples analyzed during this period were well within the accepted standards.

Much comment has been made by the Environmental Protection Agency concerning the weather and hydrographic conditions at the time samples were collected. Again I would like to point out that apparently these conclusions were arrived at when they examined data other than that used by the Texas Department of Health. Our data has been collected under all kinds of conditions and on a 12-month basis.

The Environmental Protection Agency's report makes the comment that the most unfavorable hydrographic conditions exist with northerly and northwesterly winds during or following periods of precipitation. This is a general conclusion that is not confirmed by the data available to our program. There is no general rule as to the most unfavorable hydrographic conditions that will apply to all areas of Galveston Bay all of the time. The most unfavorable hydrographic conditions will vary from area to area.

Our analysis of the bacteriological data gathered by the Galveston Bay Study, and that is not our data, it is their data, reveals that only 50 percent of the stations in the approved oyster harvesting areas attain their highest median coliform content during northerly or northwesterly wind conditions. The remaining 50 percent attain their highest coliform medians when wind conditions vary from westerly, southerly to easterly directions. If we were to follow the EPA sampling only during northerly and northwesterly winds, we would not receive a true picture of the conditions as they really exist over the oyster beds. There can be little argument with the fact that precipitation and runoff in an area, whether populated or not, will cause an increase in the bacterial count in the receiving estuary. The analysis of such data and the evaluation of its sanitary significance is a rather difficult task which would best be discussed at a meeting of individuals who are knowledgeable in the field of shellfish sanitation.

Of course, the bacteriological quality of oyster harvesting waters is important but there are other important considerations, such as heavy metals, pesticides, radionuclides and toxins. When discussing heavy metals the one that comes to mind first these days is, of course, mercury. You will note the mercury densities found in Galveston Bay oysters are all very low. The red line represents the Federal Food and Drug Administration tolerance level. Anything below that line is acceptable. You will note the examples from Todd's Dump are very low. The same holds true for Redfish Reef which I would like to point out is a reference that is located in the unapproved area and considerably closer to Morgan Point than Todd's Dump. This is a gas pipe reference located in the approved area. You will notice the density for mercury in oyster meats taken from this reef and they were well within the accepted limits.

This Chocolate Bay is an unapproved area which may be affected by industrial problems. You will notice that mercury content here is exceedingly low.

[Slide presented.]

The same holds true for Halls Lake, so, we are very proud of the fact that the mercury density we have found in the oyster meats in Galveston Bay are very low and well within the tolerance levels established by the Federal Food and Drug Administration. There are many other heavy metals that are of interest. Perhaps the best way to show the relationship of these metals to Galveston Bay oysters is to show the data reported by the EPA as we have done in this exhibit. When looking at this data we feel it is important to compare it to other regional averages, so we added a couple of columns.

[Slide presented.]

The gold colored dots represent the highest found in these particular stations as compared to the southern and eastern average contents.

The 39.70 as to 330 in the southern and 1428.0 in the eastern.

They pretty much speak for themselves. It is a little hard for me to read them from here (indicating) but, you will notice that when compared to both the southern and eastern averages, we seem to be in very good shape.

As you know, there have been no tolerance limits set for heavy metals with the exception of mercury as far as I know, therefore, we have tried to keep a close surveillance on their presence in Texas oysters as compared to the southern and eastern averages as reported to us by the Food and Drug Administration.

The Texas State Department of Health has also examined the data available to us on pesticides. Here the data which is shown in Exhibit 17 was taken from analysis reports issued by the Bureau of Commercial Fisheries Laboratory at Gulf Breeze, Florida. As you can see, this exhibit shows the minimum amounts of DDT, DDE, DDD and dieldrin to have been nondetectable. As you realize, analytical techniques and procedures are continually being improved and very few people, therefore, are willing to report a zero level. However, when you examine the levels shown here, you immediately see that we are speaking of very low residuals. In DDT, the maximum was .013; DDE, the maximum was .024; DDD, .074 parts per million and dieldrin, .030 parts per million. The median part per million was extremely low, and then, the minimum was reported as None Detectable.

The Texas State Department of Health will not address itself directly to the question of economic loss due to oysters that may be outside the approved area. It would seem from the tone and approach of the Environmental Protection Agency's Report that its objective is to prove economic loss by forcing the closure of the entire bay even if the present approved areas have been accepted by the responsible public health agency, the Federal Food and Drug Administration, as being satisfactory to produce safe, edible shellfish. Our responsibility does not include the economics of the shellfish industry but only the necessity to classify the waters as to their ability to produce safe and edible shellfish. This we have done.

We will not engage in a discussion here as to taste and odor tests and their meaning. It is sufficient to say that taste and odor is largely an individual opinion. We think it is significant that with the sale of Texas oysters running from 3 to 5 million pounds per year, 90 percent or more of which are taken from Galveston Bay, that we have not received any consumer complaints concerning Galveston Bay oysters, or, for that matter, any oysters produced in Texas. In this regard it is probably significant that with the exception of the relatively small number of oysters used by the half-shell trade, all oysters are shucked then washed with potable water prior to packaging. This is the accepted procedure used in all oyster producing States. If there was noticeable taste and odor either before or after packaging, I feel that our office would at least have received a few inquiries concerning them. We have had none in the past several years.

Great emphasis has been placed upon the presence of oils and hydrocarbons in oysters. This is a subject that we have investigated in an effort to find supporting data for the Environmental Protection Agency's position that oil and hydrocarbon densities in Galveston Bay shellfish constitute a health hazard. We have found no cases of illness that can be traced to this source. Nor have we found any conclusive evidence in the literature that would support this position. This is a matter of grave importance. Therefore, we were delighted to hear that the Food and Drug Administration had recently investigated this matter. It is our understanding that the Food and Drug Administration analyzed samples collected from the points shown in Exhibit 18. You will notice it pretty well blankets the oyster harvesting areas and also covers several areas in the unapproved areas. Many of these stations duplicate locations from which Environmental Protection Agency also collected oyster meat samples for analysis. We will not attempt to engage in a technical discussion on this subject. We would point out, however, that according to the testimony offered by the Food and Drug Administration report earlier in these proceedings that the presence of oil and hydrocarbon densities in Galveston Bay oysters does not constitute a health hazard at this time. This is a conclusion from the Federal Agency responsible for the protection of the food we eat and, of course, one in which the Texas State Department of Health concurs.

In conclusion, let the record show that the Texas State Department of Health is very interested in the improvement of our natural environment. The department's interest is not a new one but one that goes back many years as can be shown by its efforts over several decades to encourage the installation of adequate wastewater treatment facilities throughout the State.

While the department is extremely interested in the improvement of water quality throughout Texas, its major responsibility is not pollution abatement but the protection of public health. In this regard our responsibility includes the classification of the shellfish growing waters as to their ability to produce safe, edible shellfish. The Texas State Department of Health has discharged this responsibility in accordance with the National Shellfish Sanitation Program Standards and we feel have proven that:

1. The classification of the Galveston Bay shellfish growing waters is correct, as conclusively shown by the fact that no illness has ever been traced to the consumption of shellfish taken from the approved harvesting areas of Texas.

2. That Recommendation No. 1 of the Environmental Protection Agency's Report has, in fact, already been complied with. It has been proven that the Texas Shellfish Sanitation Program is in compliance with the National Standards and that there is no conclusive evidence that a health hazard exists as far as the consumption of shellfish from the approved harvesting areas of Galveston Bay is concerned.

3. Recommendation No. 2 of the EPA report has in fact already been complied with. Evidence of this is found in the Food and Drug Administration's Evaluation regularly assigned to the Texas Shellfish Program. At this point, I would like to point out that as we have mentioned before, our classification data is

available not only to the FDA representatives, but to all responsible individuals and agencies who may be interested.

4. The Environmental Protection Agency's recommendation No. 8 is being regularly carried out through the National Shellfish Sanitation Workshop organized by the National Shellfish Sanitation Program under the direction of the Federal Food and Drug Administration. Under this procedure standards are re-evaluated at regular intervals and the necessary changes incorporated into the National Shellfish Program.

Texas has followed the National Shellfish Sanitation Program guidelines for many years and as a result has had no epidemic outbreaks, or for that matter no reported illnesses that could be traced directly to the consumption of shellfish taken from approved harvesting areas.

Thank you.

CHAIRMAN STEIN: Thank you, Dr. Johnson.

(Applause.)

With that, we will stand recessed for lunch until 2:00 o'clock.

[The above-mentioned documents follow.]

(Whereupon, the conference recessed.)

EXHIBIT 1

NATIONAL SHELLFISH PROGRAM

1. State Procedures and Responsibilities

   a. Provide laws and regulations for sanitary control of shellfish industry.

   b. Make sanitary and bacteriological surveys of growing areas.

   c. Inspect plants.

   d. Issue numbered certificates to shellfish dealers who comply with sanitary standards.

EXHIBIT 2

2. Federal Food and Drug Administration Procedures and Responsibilities

1. Make annual review of State's control program.
2. Endorse or withhold endorsement of State program.
3. Endorsement allows sale of shellfish into interstate commerce.

EXHIBIT 3

Shellfish Industry Procedures and Responsibilities

1. Cooperates in obtaining shellfish from approved harvesting areas.

2. Provides plants that meet standards.

3. Properly labeling each package of shellfish with certificate number and other necessary data.

EXHIBIT 4

ANNUAL EVALUATION OF TEXAS SHELLFISH PROGRAM

By F. D. A. - P. H. S.

SHELLFISH YEAR	OVERALL RATING OF TEXAS PROGRAM
1969-1970	95.7%
1968-1969	96.0%
1967-1968	93.6%
1966-1967	94.1%
1965-1966	94.2%
1964-1965	91.0%
1963-1964	89.8%

EXHIBIT 5

NATIONAL SHELLFISH SANITATION PROGRAM
BACTERIOLOGICAL STANDARDS

1. Approved Growing Areas

   a. Coliform median MPN of the water does not exceed 70 per 100 ml., and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 ml. for a 5-tube decimal dilution test. (These limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard).

EXHIBIT 6

2. Conditionally Approved Growing Areas

   a. Same as approved (Quality of area may be affected sporadically).

3. Market Shellfish at Wholesale Level

   a. "Fecal coliform density of not more than 230 MPN per 100 grams and a plate count of not more than 500, 000 per gram will be acceptable without question."

EXHIBIT 7

OYSTER REEF LOCATIONS
GALVESTON BAY

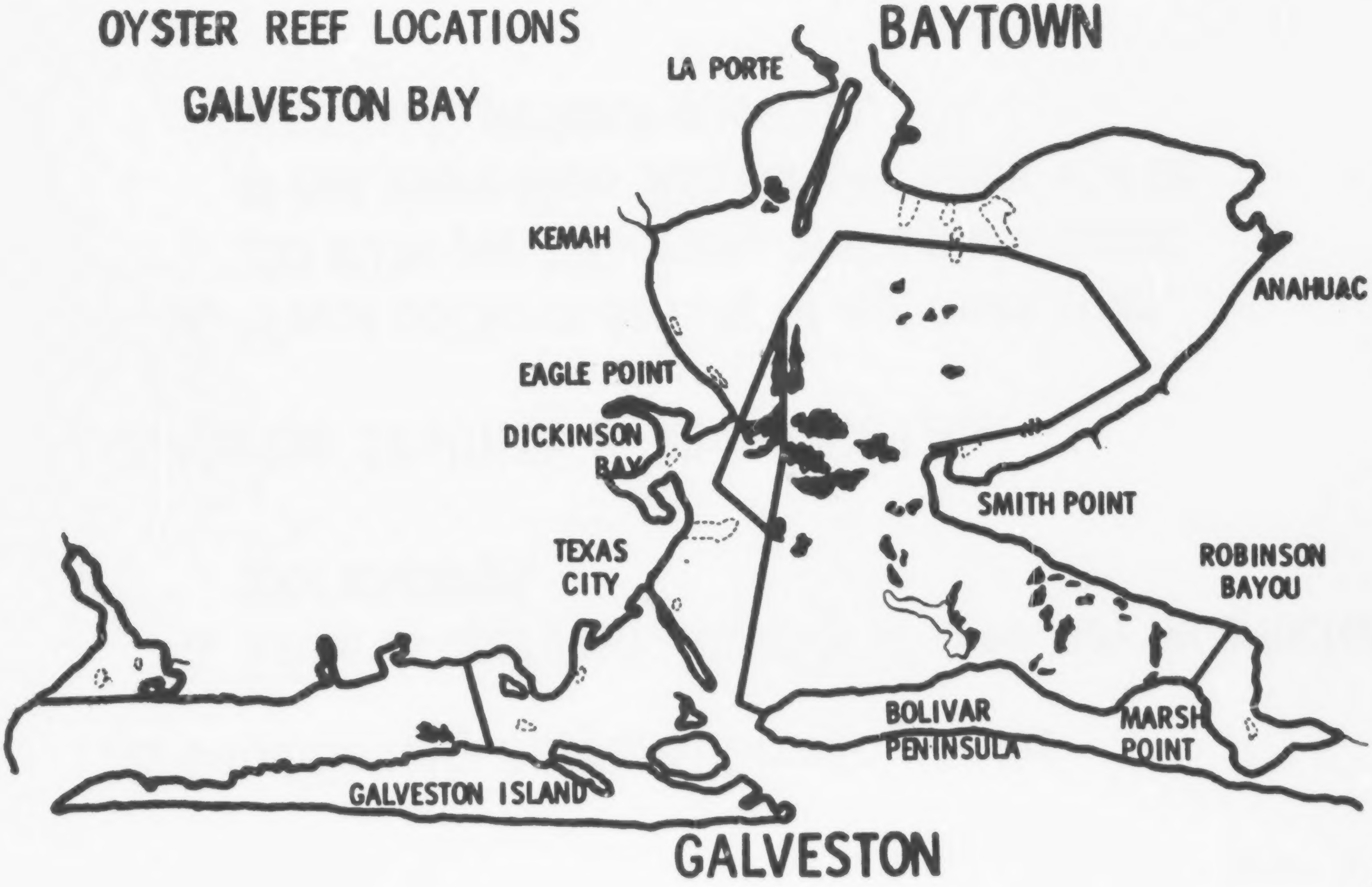
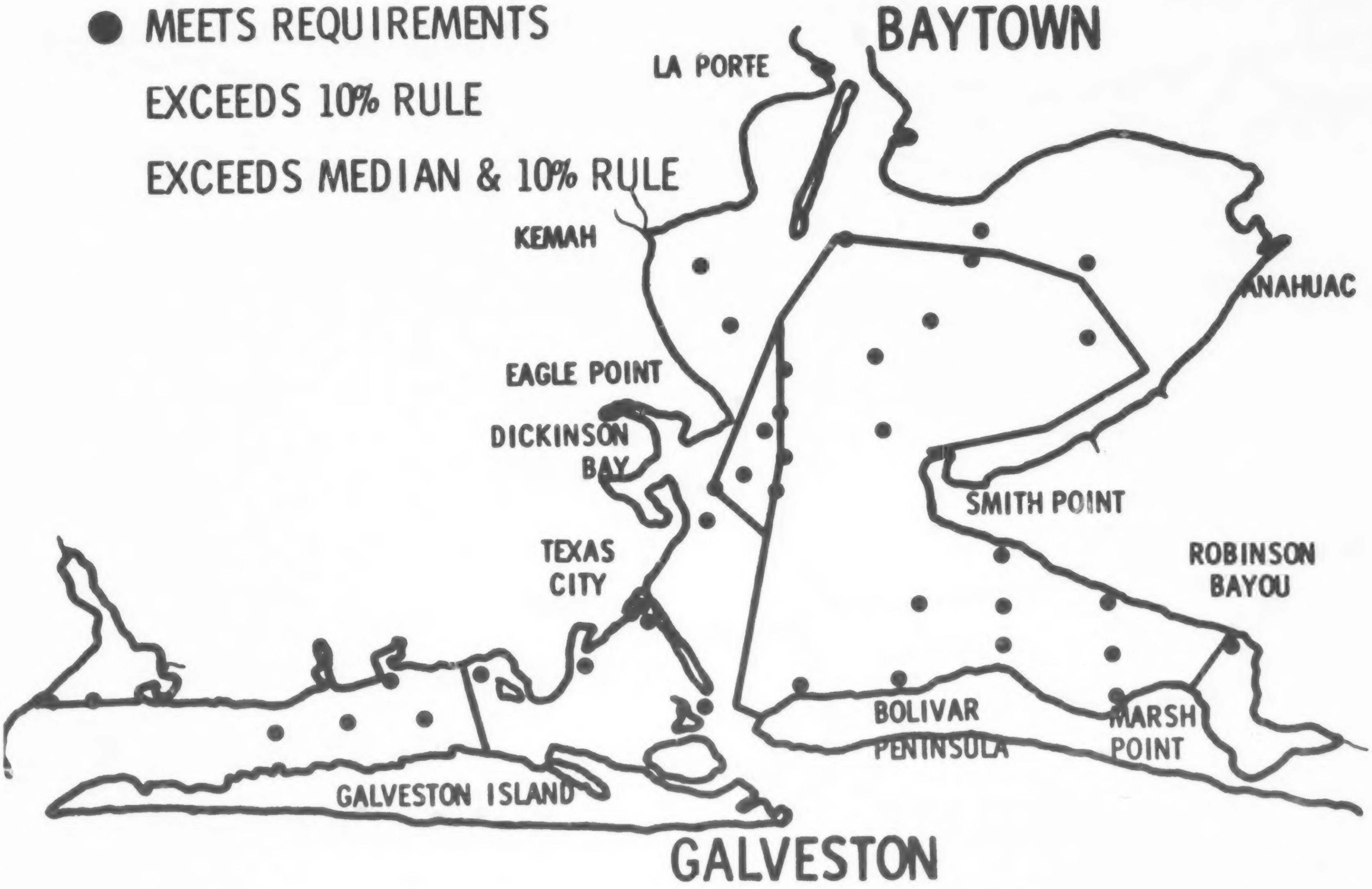

BAYTOWN
LA PORTE
KEMAH
ANAHUAC
EAGLE POINT
DICKINSON BAY
SMITH POINT
TEXAS CITY
ROBINSON BAYOU
BOLIVAR PENINSULA
MARSH POINT
GALVESTON ISLAND
GALVESTON

EXHIBIT 8A


● MEETS REQUIREMENTS
EXCEEDS 10% RULE
EXCEEDS MEDIAN & 10% RULE
BAYTOWN
LA PORTE
KEMAH
ANAHUAC
EAGLE POINT
DICKINSON BAY
SMITH POINT
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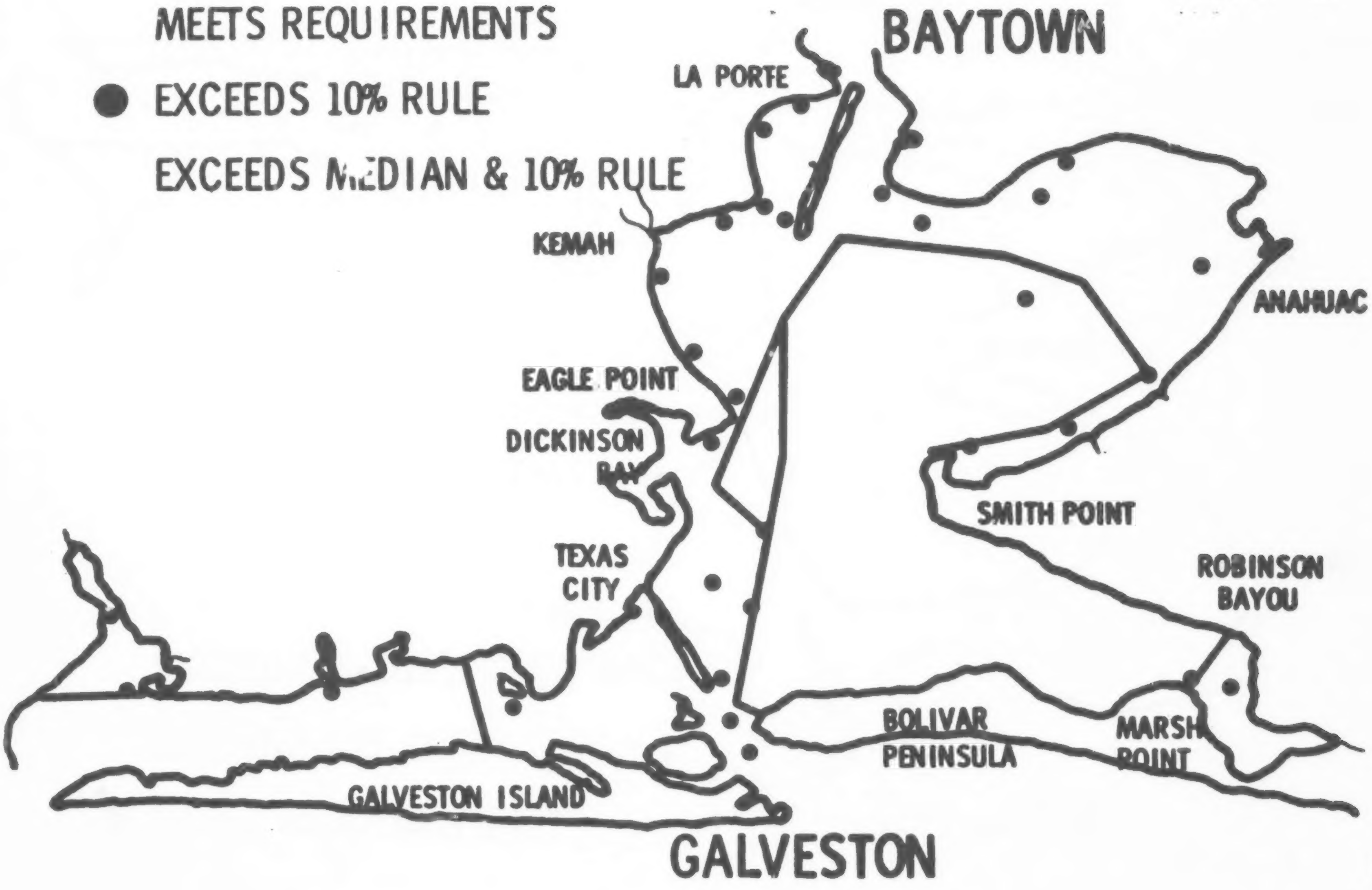
BOLIVAR PENINSULA
MARSH POINT
GALVESTON ISLAND
GALVESTON

EXHIBIT 8B


MEETS REQUIREMENTS
● EXCEEDS 10% RULE
EXCEEDS MEDIAN & 10% RULE
BAYTOWN
LA PORTE
KEMAH
ANAHUAC
EAGLE POINT
DICKINSON BAY
SMITH POINT
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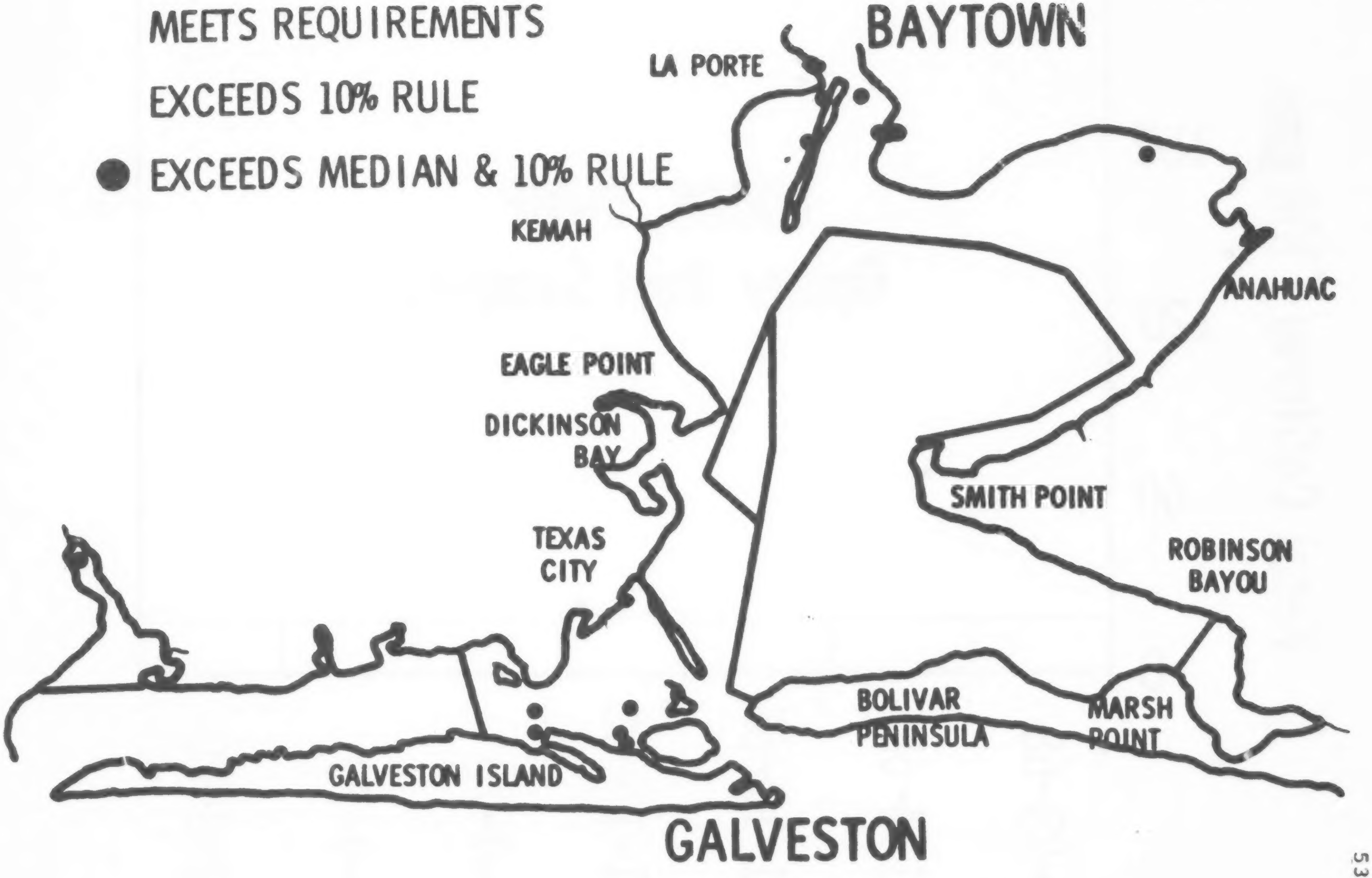
BOLIVAR PENINSULA
MARSH POINT
GALVESTON ISLAND
GALVESTON

EXHIBIT 8C


MEETS REQUIREMENTS
EXCEEDS 10% RULE
● EXCEEDS MEDIAN & 10% RULE
BAYTOWN
LA PORTE
KEMAH
ANAHUAC
EAGLE POINT
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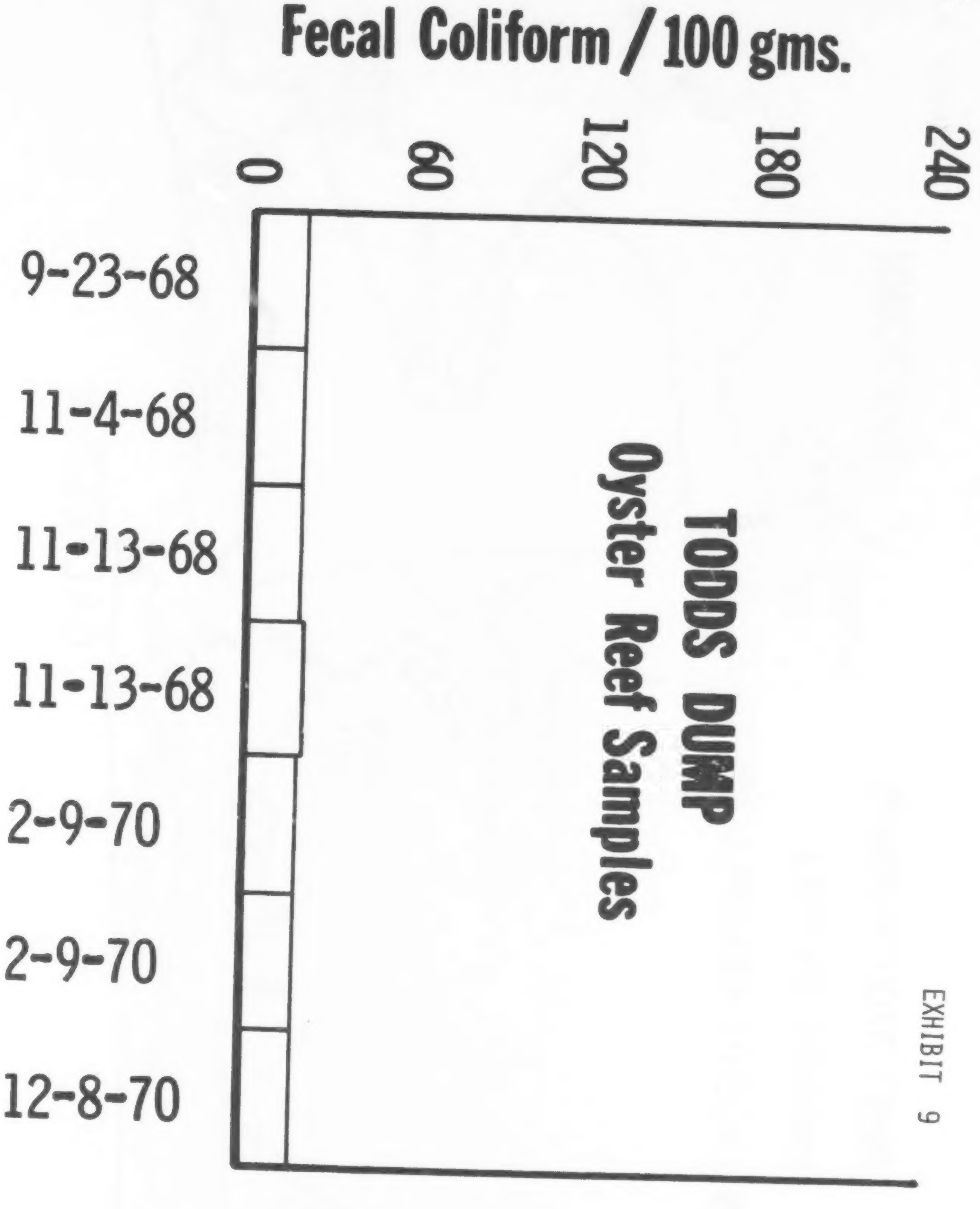
ROBINSON BAYOU
BOLIVAR PENINSULA
MARSH POINT
GALVESTON ISLAND
GALVESTON



TODDS DUMP
Oyster Reef Samples

EXHIBIT 9

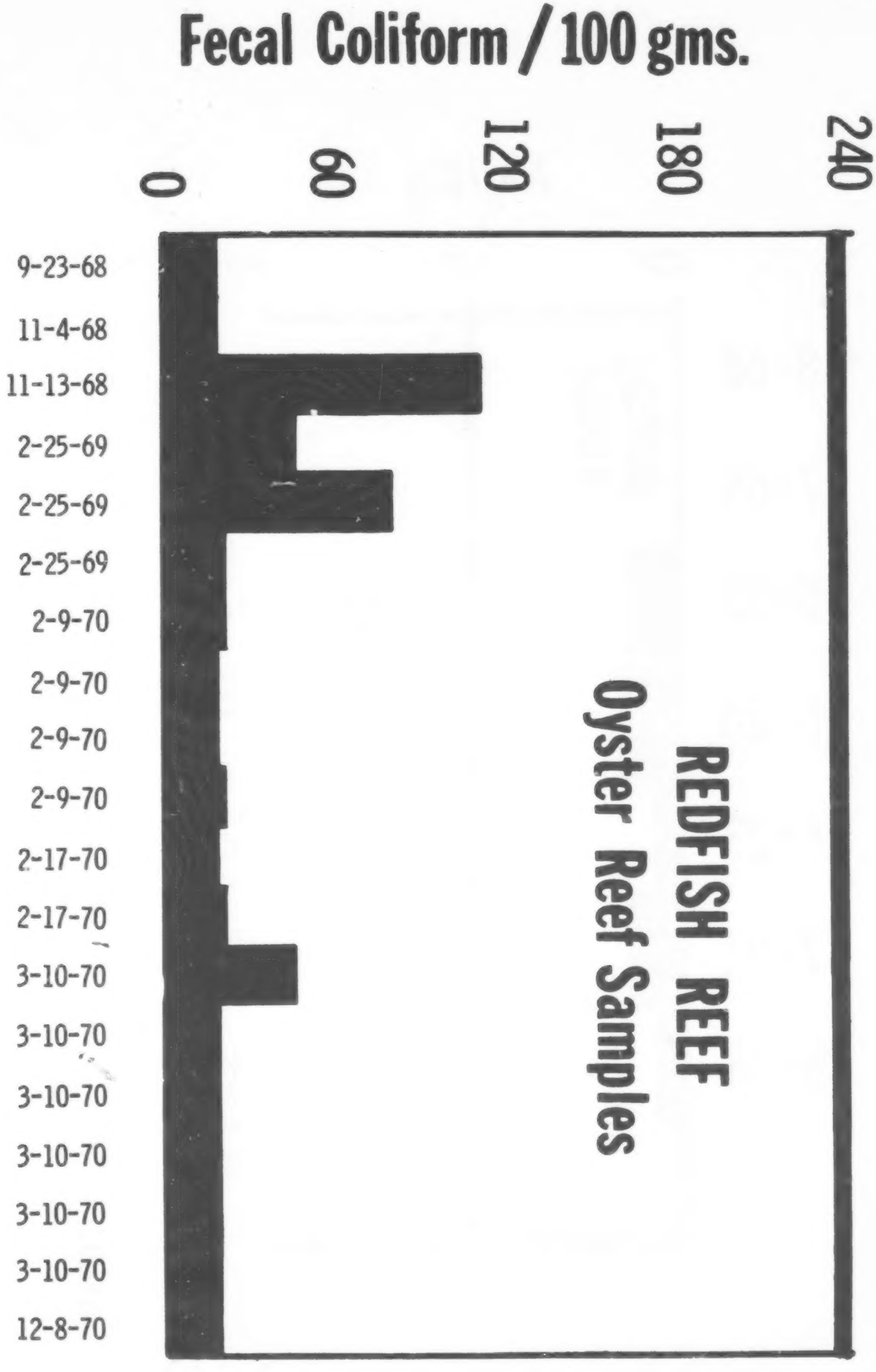

Fecal Coliform / 100 gms.
0
60
120
180
240
9-23-68
11-4-68
11-13-68
2-25-69
2-25-69
2-25-69
2-9-70
2-9-70
2-9-70
2-9-70
2-17-70
2-17-70
3-10-70
3-10-70
3-10-70
3-10-70
3-10-70
3-10-70
12-8-70
REDFISH REEF
Oyster Reef Samples

EXHIBIT 10

EXHIBIT 1

Mercury in Oysters – 1970

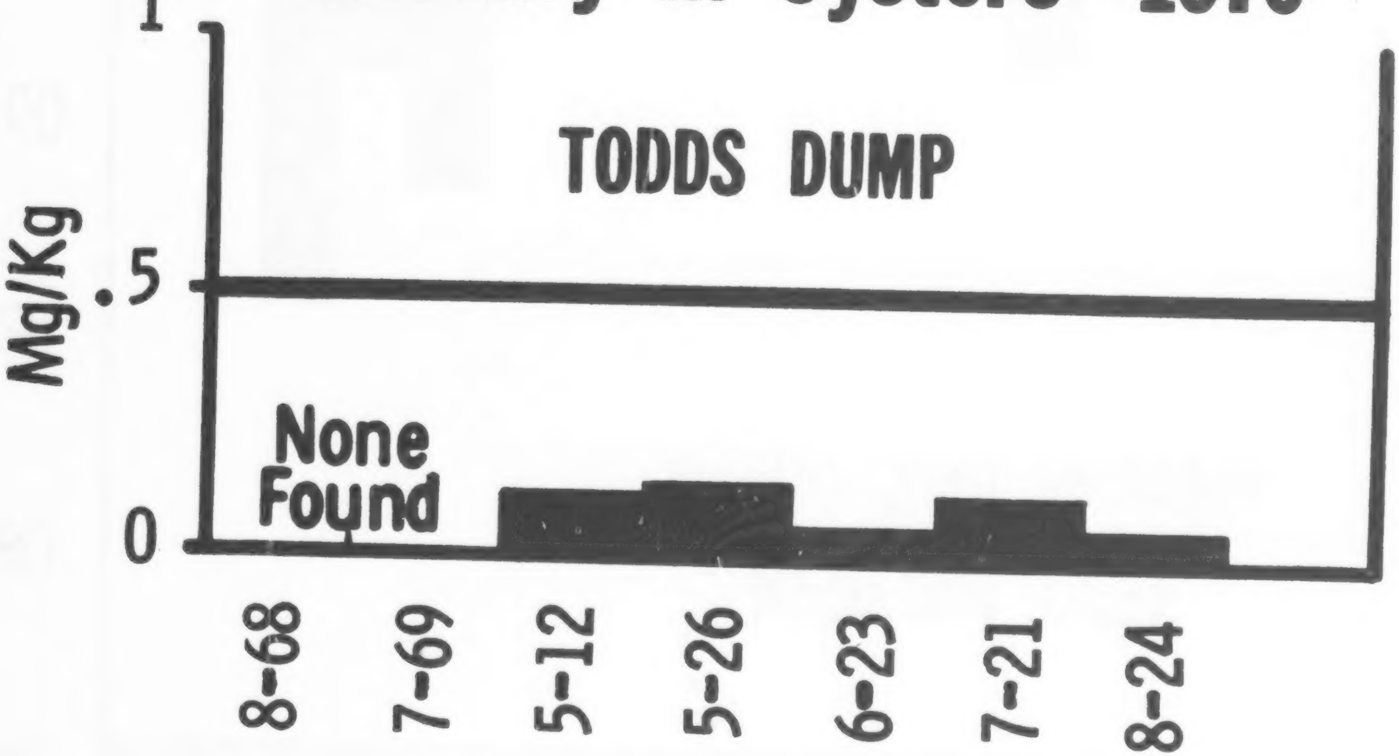


EXHIBIT 13

Mercury in Oysters – 1970

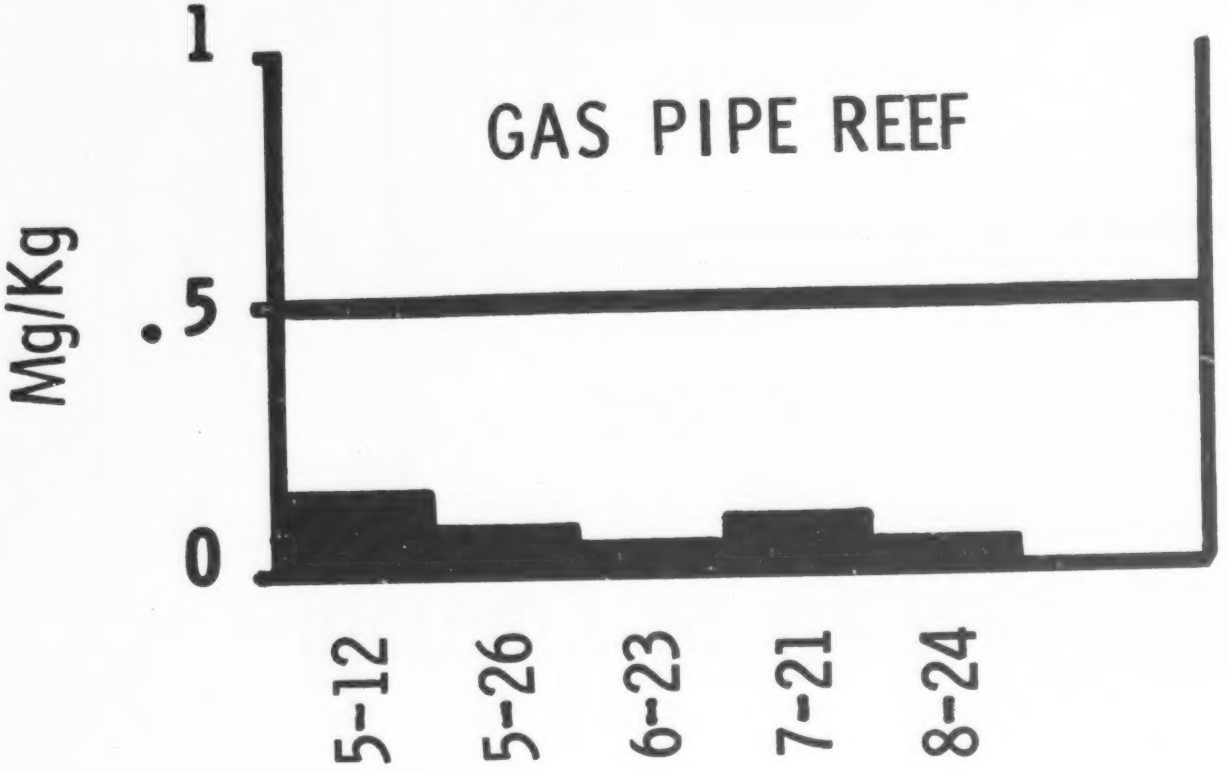


EXHIBIT 14

Mercury in Oysters – 1970

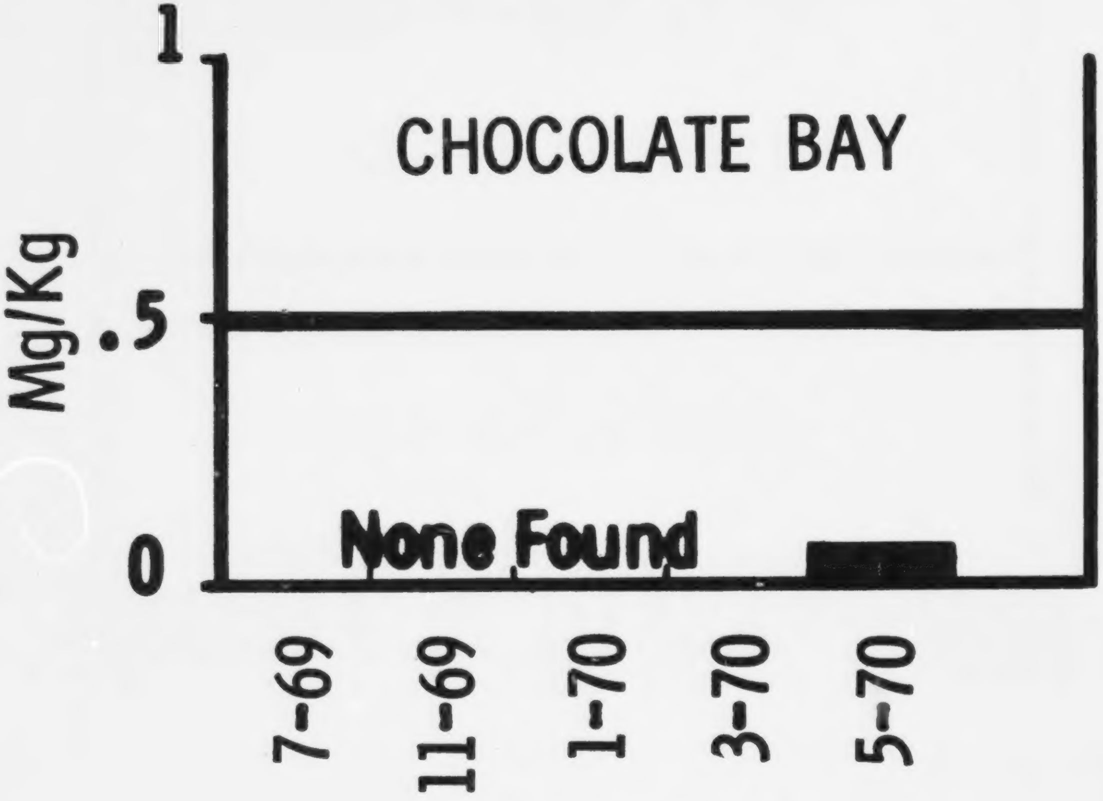


EXHIBIT 15

Mercury in Oysters – 1970

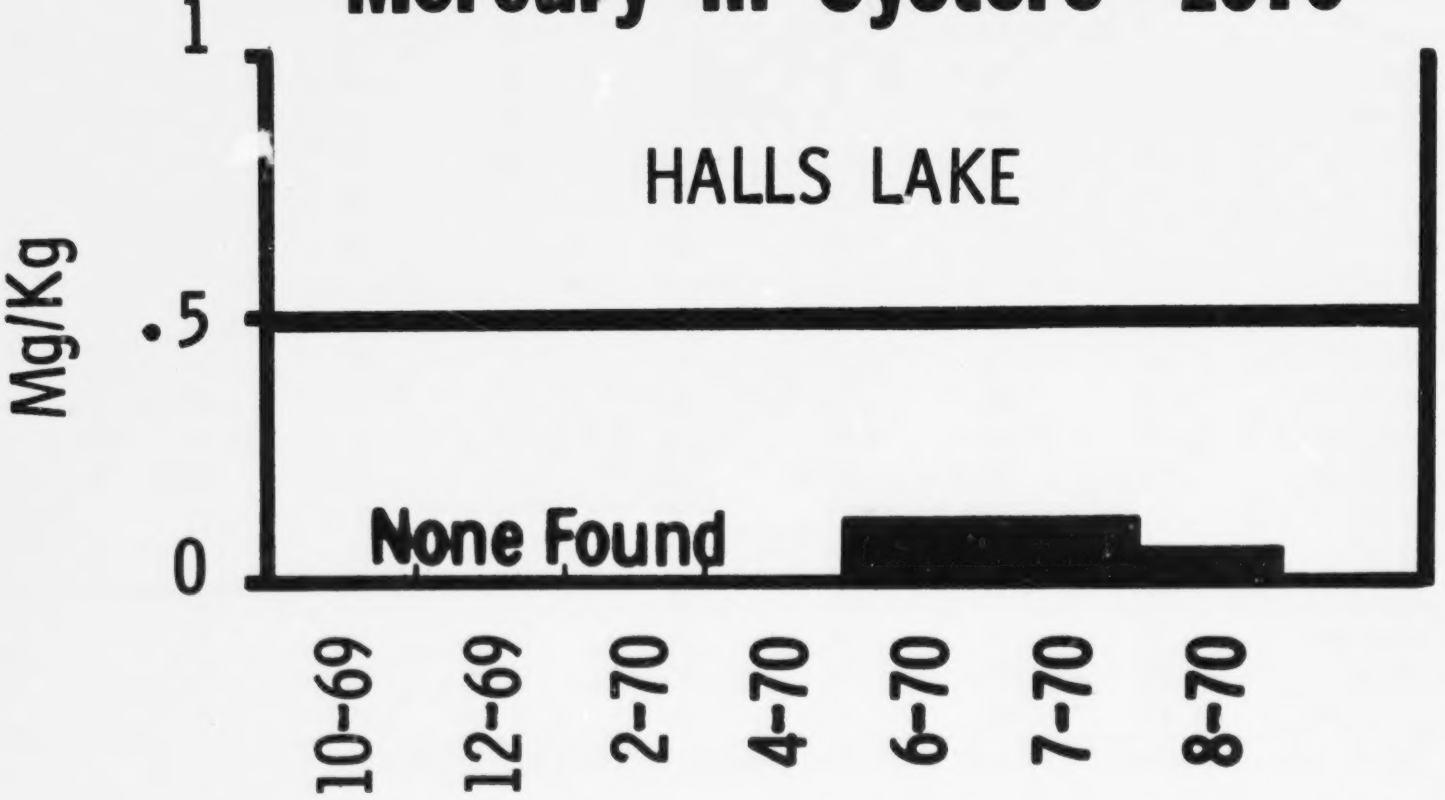


EXHIBIT 16

METALS CONCENTRATIONS IN OYSTERS FROM GALVESTON BAY[1]
NOVEMBER 12, 1970
(MICROGRAMS PER GRAM - WET WEIGHT)

Parameter	Sta. No. 1	Sta. No. 2	Sta. No. 3	Sta. No. 4a	Sta. No. 5	Sta. No. 6	Sta. No. 7	Av. Content Southern[2]	Av. Content Eastern[3]
Zinc	35.30	39.70	20.46	26.12	21.58	20.26	22.87	330	1428.0
Copper	8.24	9.52	5.06	4.79	4.13	7.80	5.23	17.0	91.5
Cadmium	.41	.15	.15	.15	.15	.15	.15	.95	3.1
Lead	.30	.30	.30	.30	.30	.30	.30	1.2	.47
Chromium	.07	.07	.26	.07	.27	.42	.16	.35	.40
Mercury	.008	.062	.028	.040	.030	.045	.007		
Arsenic	.30	.30	.30	.30	.47	.30	.30		
Boron	.87	1.65	.66	.58	.78	.38	.76		
Phosphorus	270	258	102	225	185	102	196		
Iron	14.71	12.30	4.63	7.34	5.55	5.93	13.10		67.0
Molybdenum	.47	1.32	1.51	1.57	1.01	.99	.29		
Manganese	1.18	.67	.36	.70	.47	.50	.83		4.3
Aluminum	21.77	17.84	8.51	13.50	12.33	16.51	25.10		
Beryllium	.0015	.0015	.0015	.0015	.0015	.0015	.0015		
Silver	.25	.015	015	.015	.015	.015	.11		
Nickel	.24	.75	.15	.37	.15	.15	.25		.19
Cobalt	.15	.15	.15	.15	.15	.15	.15		.10
Vanadium	.30	.30	.30	.30	.30	.30	.30		
Barium	.20	.03	.04	.15	.07	.06	.15		
Strontium	1.53	1.65	1.72	1.80	5.92	3.45	2.40		

[1] Taken from EPA report on pollution affecting shellfish harvesting in Galveston Bay, Texas.

[2] Data from FDA

[3] Data from Pringle & Shuster "Guide to Trace Metal Levels In Shellfish"

EXHIBIT 17

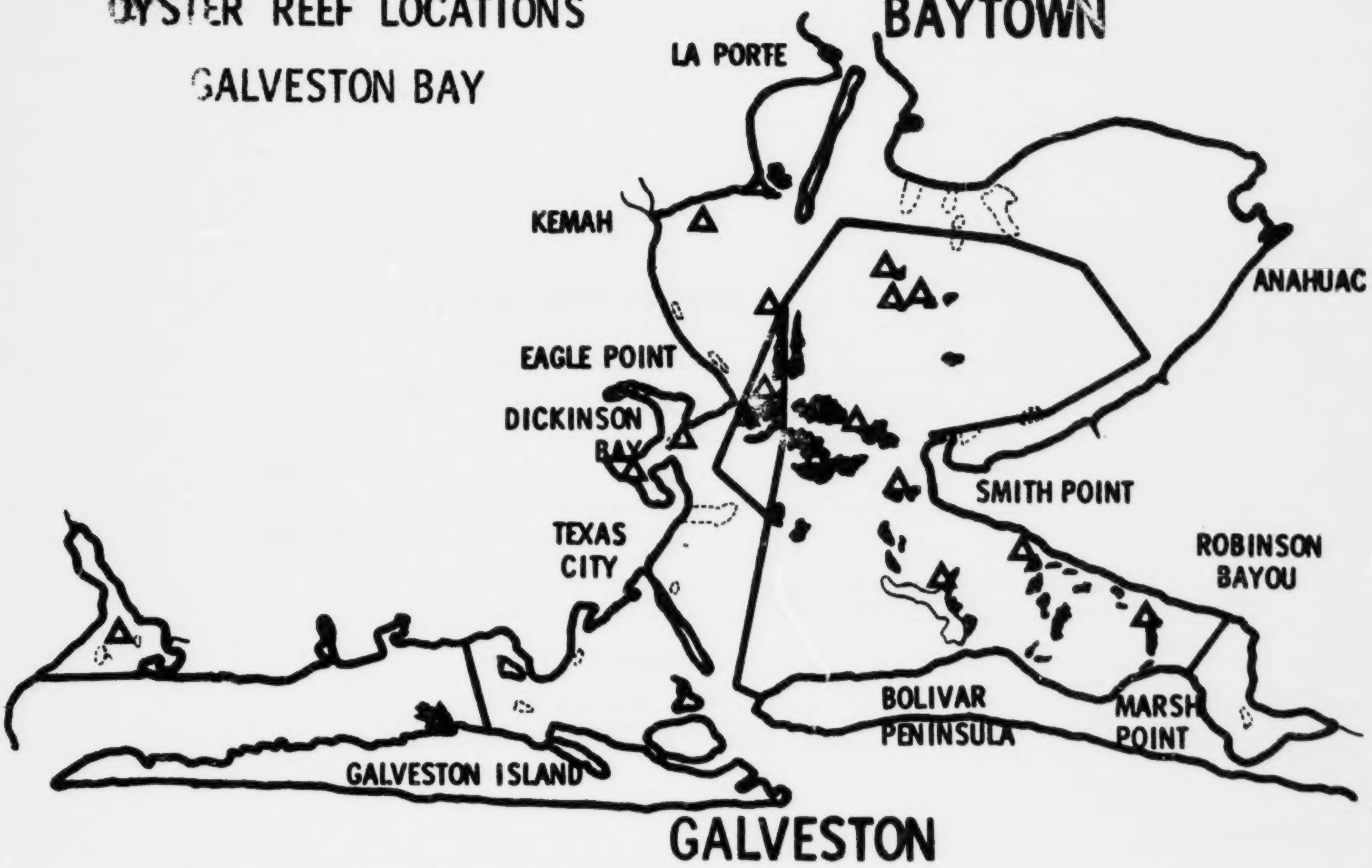
PESTICIDE RESIDUE IN OYSTER MEATS
TODDS DUMP 1965-1971
(51 Samples)

	DDT	DDE	DDD	DIELDRIN
Maximum (ppm)	.013	.024	.064	.030
Median (ppm)	ND*	trace	.029	trace
Minimum (ppm)	ND*	ND*	ND*	ND*

ND* - None Detectable

EXHIBIT 18

OYSTER REEF LOCATIONS
GALVESTON BAY


BAYTOWN
LA PORTE
KEMAH
ANAHUAC
EAGLE POINT
DICKINSON BAY
SMITH POINT
TEXAS CITY
ROBINSON BAYOU
BOLIVAR PENINSULA
MARSH POINT
GALVESTON ISLAND
GALVESTON

SAMPLE COLLECTION POINT △

CHAIRMAN STEIN: May we reconvene?

MR. YANTIS: Dr. Carl Oppenheimer is the Director of the University of Texas, Institute of Marine Sciences, at Port Aransas, Texas. He has just returned to Texas after having been in other States -- I believe Florida, for a number of years. Dr. Oppenheimer?

CHAIRMAN STEIN: Do you have a prepared statement, sir? Do you want to give a copy to the reporter?

DR. CARL OPPENHEIMER
INSTITUTE OF MARINE SCIENCES
UNIVERSITY OF TEXAS
PORT ARANSAS, TEXAS

DR. OPPENHEIMER: Thank you for the opportunity to speak before you this afternoon.

I must apologize to those who have a copy of the prepared statement. I did it in such a rush yesterday that I didn't have time to proofread until I came up this morning and noticed a few mistakes. This will be corrected for the record.

However, I know that I am not the only one responsible for a couple of mistakes. Because in reading the little black book, which I had a copy of this morning, I also found that a somewhat similar mistake was made in editing, especially on Page 43 where it indicates that the West Falmouth Harbor in Massachusetts, because it had shellfish hydrocarbon contents from 4 to 12 ppm -- it should have been parts per 100,000 or 40 to 120 ppm, based on Max Blumer's paper. This, of course, brings up rather interesting aspects regarding hydrocarbons.

Hydrocarbons have been bandied about lately for some popular pressure reason I guess, without the people taking serious consideration on how hydrocarbons evolve.

Hydrocarbons were made by living organisms, and if you go through the tremendous amount of literature that is amassed since 1930, when the techniques became available for hydrocarbon analyses and more specific molecules, you will find all living systems have hydrocarbons about the same range that were found in the oysters that resulted in the closure

Dr. C. Oppenheimer

of West Falmouth. That is, from 100 to 150 to 200 ppm. And, in fact, some organisms have up to 1 percent their dry weight as hydrocarbon material.

If you look at the structure of the hydrocarbon, you will find another rather fascinating thing that has occurred during the past. That is, there are two major groups of hydrocarbons. We will call these the straight chain hydrocarbons, or the normal paraffinic hydrocarbons.

They are just a string of carbon atoms fairly lengthy. They range from, methane-wise, 1 carbon up to 32 and 34 carbon numbers per molecule.

Then there is another group of ring structures called aromatics like benzene and toluene and so on. These materials also range in about the same number of carbon atoms except they are much more complex.

Those people who are doing analytical procedures find the straight chain hydrocarbons are very easy to analyze whereas the ring ones are extremely difficult.

So, the literature has very little

Dr. C. Oppenheimer

information about the ring-type hydrocarbons. But, one can make certain analyses if you look at the total concept of the crude oil.

It wasn't until about 1930 that we became interested in recent sediments, or the evaluation of hydrocarbons in a chemical sense. At this time, there was a fairly extensive survey made to determine whether there were recent hydrocarbons and sediments. At that time it was stated there were none.

Then in about 1952, Dr. Paul Smith, using one of the first prototypes of gas chromatography or liquid chromatography, found recent marine sediments and in 1954 indicated they were present from 120 to 1400 ppm of the organic fraction.

This was attributed to living organisms. If we consider the total production in organic carbon per year, which is about (4 x 10^{13}kg) -- this is based on available data that we have on primary fixation and that is the amount of conversion of carbon through sunlight energy. Through protoplasm, we have 4 x 10^{13}kg of carbon which is produced in the world's oceans.

If we use a rather reasonable figure of 10 ppm hydrocarbons, we come out with a value of 4 x 10^8kg of hydrocarbons produced as a part of biological activity. This is quite a large amount of hydrocarbon. It amounts to something like 800 billion pounds of hydrocarbons per year. Of all types.

Gas chromatography of living systems, as shown in the literature -- and I place representative bits of information in the material that I submitted -- there are hydrocarbons of all types in the olefins and aromatics in living systems.

Now, this amount of annual production is equivalent to about 15 days worth of mass transport of oil around our globe, which is estimated today to be about 3 billion gallons per day. That is how much hydrocarbons you and I use in our energy, running our automobiles, and all of these other things that we would just as soon not give up to decrease pollution. This is worth 15 days of the total world's movement of oil at 3 billion gallons a day. So, it is a sizeable amount. It is going to be very difficult to determine where toxicity of these normal occurring hydrocarbons occur and where it is absent, when it is spread so uniformly amongst our living systems.

It is going to take a considerable amount of research to work with the aromatic hydrocarbons to find out if there are any that are responsible for health hazards.

At the same time you can look around your environment -- the total environment, not specific places that are terminals for very large amounts of oil transports which are going to have spills normally -- but, if you look at our world as a total, you will find that outside of the deposits of the commercial oilfield there is no larger concentration of hydrocarbons today. And this is despite the fact that we sanctioned the use of 2-cycle outboard motors, which places oil directly in the aqueous environment. This happens to be legal or sanctioned or has some other aspect. And all of the aerosols that we use as propellants; all of the cans that you have that say they have an inherent high base are propelling hydrocarbons into our atmosphere at an increasing rate. This is allowed by law.

And still we do not have large concentrations of any specific molecules that are recognized in the environment over a few ppm composition.

You would expect over the millions of years that hydrocarbons of a specific nature would accumulate, but they haven't.

Out at the Santa Barbara oil spill -- which I happen to be a member of the President's Panel to look at that -- the group who has made a study published their first report just a couple of weeks ago, and this indicated that outside of damage to birds, they could not determine scientifically any disadvantage of the oil.

Well again, this is only natural because the Santa Barbara oilfield has a natural seepage and these natural seepages are found all over the world. But this one is a very good one, because I happened to grow up in that area and went swimming at the beach of Carpinteria as a young man when we had to take coaloil with us to clean the tar off our feet. Because oil geographically described as being on the Ventura oilfield has been seeping out about 500 gallons per day for the last 1,000,000 years and yet this oil is taken up by the environment.

I guess the point that I should like to emphasize is that it is very easy to be misled by too few data bits. It is very easy to extrapolate. I am not saying that we shouldn't be aware of the problems of oil contamination, but I am saying that we should be judicious in our control and have enough basic information so that we can make logical conclusions. Otherwise we are going to force our economy to a place where perhaps we will no longer have automobiles to drive; powerplants will be restricted; and this concerns me not only as a scientist but also as a human.

Thank you very much. (Applause.)

CHAIRMAN STEIN: Thank you, Dr. Oppenheimer.

Do I understand you to say as far as the Houston Ship Channel is concerned, that we don't have enough information about controlling hydrocarbons now, and you think we probably need further study?

DR. OPPENHEIMER: No. I am saying you do not know where the hydrocarbons in the living systems that you measured come from.

CHAIRMAN STEIN: What do you think we should do about it?

DR. OPPENHEIMER: Well, I think that there are ways to learn and understand --

CHAIRMAN STEIN: How do we do that other than through study, sir?

DR. OPPENHEIMER: That is the only way.

CHAIRMAN STEIN: In other words, you are suggesting that we study it?

DR. OPPENHEIMER: I am suggesting that you have a few more facts before statements are made.

CHAIRMAN STEIN: How are we going to get the facts?

DR. OPPENHEIMER: Let's see. Your group is spending something like $1-1/2 million to fingerprint crude oils. This is a good start. But it is going to be very difficult.

It will require control growth experiments. It seems to me the prior evidence indicates oil is really not going to be harmful, so perhaps we should be using the money for something else like mercury or barium. (Laughter.)

CHAIRMAN STEIN: Let me see what you are suggesting now. I don't know. I thought I understood you to say we don't know enough about hydrocarbons, so we should study it some more. You figure since it is ubiquitous it is not going to do any harm; therefore, we shouldn't even study it. Is that what you are saying?

DR. OPPENHEIMER: No.

CHAIRMAN STEIN: I would like to understand what we are supposed to do with the hydrocarbons.

DR. OPPENHEIMER: There are two things you can do. One is you can make an exhaustive literature survey because there is a tremendous amount of literature available. Get a panel of people together to synthesize this and come out with some statements indicating the way you should move. It is quite obvious in the open sea that there is no hydrocarbon problem -- that there is no known evidence that it is damaging. There is no evidence that hydrocarbons are there, but it has to be demonstrated scientifically that it is damaging.

Now you can move into the extreme

environments and do the same thing. You can go from an extreme to a very polluted environment like Boston Harbor, for example.

We are working on a project for you now using techniques of seed oil to bacteria to allow it to clean up and it is being supported by EPA.

CHAIRMAN STEIN: Why do that if they are not going to cause harm? If hydrocarbons are not a problem, why do you want to do that?

MR. YANTIS: Murray, he has not said that.

If I may intervene -- and I am going to take advantage of my position -- all he said was that when there are small traces of hydrocarbons found in nature, it is not a cause for panic. He said nothing beyond that.

I also recall in his testimony -- and it is going to come out later -- you have recommended that the oil increase allowance to be discharged from -- I say you; I mean the EPA -- to be discharged from the industries along the Houston Ship Channel be reduced to zero.

Now that is not possible, and no one in

his right mind thinks it is possible.

We can get it to a very low number, and that low number will certainly be tolerable.

I might further say that we use the tests shown in the book called Standard Methods, which simply defines anything that is reported on the test as oil and grease. It doesn't mean it is oil and grease.

I am told if an industry uses an oxidation pond and therefore has algae in its effluents, that the test will even report the oils that are chlorophyll in the algae as oils.

So, I just don't think you ought to pursue that type of question. All we are trying to say is a small amount of oil may be natural for the environment and is no cause for panic, and that is all the Doctor said.

CHAIRMAN STEIN: I am glad you saved me all that time, Hugh, and glad you told me what Dr. Oppenheimer said. I appreciate it.

MR. QUARLES: I would like to ask a question about this though.

I think whenever an oil spill occurs around the country, the public is concerned and the Environmental Protection Agency has been concerned. Are you suggesting we should not be concerned?

DR. OPPENHEIMER: I suggest you pass a law requiring all oil-handling machinery to be licensed; that all loading areas between land and water and even over land have proper cofferdams to withhold the oil in case it does spill; and pass a few other laws of an equivalent nature that will allow you to protect the environment, because this is where most of the spillage comes.

It is going to be very difficult to contain tanker spillages from accidents at sea, even though this is being looked at now by selecting specific lanes. And until the world's maritime authorities get together and enforce certain requirements on ship handling, you will always have the occasional accident with an oil vessel. But, there also you can do very constructive, or set up very constructive procedures for handling some of the oil spillage.

MR. QUARLES: I think there are two

related but distinguishable issues involved. One is the feasibility of various control measures and the other is the question of whether there is something there that ought to be controlled. I gather, in your last comment there, that you are addressing yourself to the feasibility of the control measures.

I understood you to be suggesting that there wasn't really something there that calls for controls.

DR. OPPENHEIMER: No evidence to my knowledge indicates any toxicity of oils in the natural environment.

CHAIRMAN STEIN: I think that is good.

By the way, I don't want to repeat this, but I hope we will be able to check your tables. They won't reproduce and we are going to have to get other copies. I won't repeat that with everyone who comes up.

DR. OPPENHEIMER: I cannot give you any more than you have there. See, those are reproductions.

CHAIRMAN STEIN: But, in order to make them come out in our transcript, we are going to have to have on original or something we can reproduce. This will be redone. By the way, do you want the statement that you admitted to be in the record?

DR. OPPENHEIMER: Yes. I would like to have the opportunity to correct a few places.

CHAIRMAN STEIN: But I am intrigued by two of your sentences here, and I would like to know if you want them in the record. You didn't read them.

It says, and let me quote, "Pollution seems to be a rather burgeoisie term in that it can be made to fit any situation. It is quite obvious that our planet has been polluted with oil and coal and lignites far earlier than man's habitation."

DR. OPPENHEIMER: I think that is a true statement.

CHAIRMAN STEIN: Right. Thank you.

[The above-mentioned statement follows.]

HYDROCARBONS IN LIVING ORGANISMS

Hydrocarbons are a rather intriguing natural entity. It seems almost diabolical that these essential molecules that have been a part of living systems during biological evolution (Calvin 1970) are now considered pollution. "Pollution"seems to be a rather bourgeoisie term in that it can be made to fit any situation. It is quite obvious that our planet has been polluted with oil and coal and lignites far earlier than man's habitation.

The occurrence of hydrocarbons in living systems is a relatively recent finding, namely because the techniques needed for the analysis of the complex nature and diversity of the molecules of hydrocarbon have only recently been developed. Parker Trask (1942) in his monumental work of the 1930's stated that hydrocarbons were not present in any significant amounts in recent marine sediments. It was a common theory at that same time that hydrocarbons were produced primarily by sedimentary marine conditions and that biological activities were primarily responsible. During the evolution of new chemical techniques, Smith in 1952 demonstrated that hydrocarbons were present in recent marine sediments and in 1954 indicated that they were present from 120-1400ppm of the organic fraction. Orr and Emery (1956) found significant paraffinic hydrocarbons at the surface sediments off the California Coast and indicated by hydrocarbons in the depths of the sediment that recent oil activities were not responsible for the accumulations of the hydrocarbons.

Figure 1 taken from Davis (1967) points out, as an example of extent, the many natural hydrocarbon seeps in the southwestern part of the United States. Smith (1952) calculated that one cubic mile of recent sediment may have 13 x 10^6 barrels of petroleum and pointed out that this is undoubtedly due to the natural production of hydrocarbons in living systems that may have an average of 100ppm hydrocarbons per dry weight. It has been suggested that the total annual oceanic carbon fixation as protoplasm is about 4 x 10^{13}. kilograms, which at only 10ppm hydrocarbon (below average) would produce about 4 x 10^8 Kg of hydrocarbons a year. This is 800 billion pounds a year, and approximately equivalent to 15 days transportation at our present estimated daily use of 3 billion gallons per person. This amount is significant and yet we know very little about the biological aspects other than some preliminary work ón content.

The book, "Petroleum Microbiology" by Davis (1967) provides a good review of the degradation and production of hydrocarbons in nature. With the large amount of natural seepage and production of oil, plus the movement of oil for energy, our environment has been subject to oils for geological time. For example, Pitch Lake in Trinidad, first referenced by Columbus for tarring his ships, is estimated alone to produce 25 million tons of asphalt through the years. To this can be added the hydrocarbons from coal (Gould 1966), etc. If natural oxidation, both physical and biological, did not take place there would be a great accumulation of hydrocarbons in the environment. A review of the literature suggests that such hydrocarbons have not accumulated and that oxidation through living systems must be a common fact.

Here it might be pertinent to point out that in any discussion of oil pollution today one must seriously consider the tremendous surface of asphaltic roads in the world. These may be producing significant amounts of hydrocarbons to the environment as they weather, break down, and are otherwise disseminated. These road surfaces are hydrocarbons. To this may be added the tons of protective asphaltic coatings used for pipes, etc., the oils used in two cycle engines, especially the outboard powerboat motors, unburned hydrocarbons in exhaust, and finally the hydrocarbons used as inert carriers in aerosol dispensers for a multitude of products used every day. Such sources of hydrocarbon pollution must be discussed in terms of biological aspects because for most cases, although the amounts are disseminated, they add up to significant amounts per year. Thus living systems are constantly subjected to such hydrocarbons. They may not be seen as major oil spills, but may be much more significant when one attempts to set criteria for hydrocarbon content in living systems.

Orr and Emery (1956) provide information relating to the presence of various hydrocarbons in the California offshore basins (Table 1). Figures 2 and 3 taken from Brogden (1969) indicate that normal hydrocarbons are present at 160ppm in plankton and increase in hydrocarbon content when sediment-plankton mixtures are anaerobically degraded by microorganisms. Hann, et al (1967) show in Table 2, and Patterson (1967) in Figure 4, hydrocarbons and gas chromatographic spectra for cultured algae and bacteria. To show the complexity of hydrocarbon distribution in living systems, Tables 3 and 4 from Stransky and Streibl (1968) provide an example of detailed information relating hydrocarbon by carbon atoms to the structure of certain plants.

Clark (1966) in his Thesis showed the abundance of normal hydrocarbons in marine plants and animals to range between C14 to 32 at an amount of 34-120ppm dry weight and compared it with the production of Australian cane grass that had an alkane content of almost one percent of the dry weight. Clark also gives a very good summary of alkane hydrocarbons in living organisms. It is quite significant to note that hydrocarbons have been a significant part of the organic matter of protoplasm of most terrestrial plants as well as marine plants.

Unfortunately, most of the literature refers to the saturated straight chain hydrocarbons and only a part of the total hydrocarbons. The aromatic or cyclic hydrocarbons are much more difficult to quantitate or identify. If one looks at the analytical procedures of the various authors listed in this paper, it becomes quite obvious that they have not considered the aromatic or the most abundant of the hydrocarbons. However, the data of Orr and Emery (1956) indicate that they are more abundant than the aliphatic compounds.

The exhaustive study of Hopkins of Texas A&M University of the 1940's, who indicated in API Project 9 that oysters were little influenced by hydrocarbon in the Louisiana Delta and by the Allan Hancock Foundation (1971) report of the Santa Barbara incident, suggest that it is difficult to determine the effect of hydrocarbons on living systems as all their findings, except for birds, were that oil did not affect the local population. Perhaps the reason was that Coal Oil Point off the Santa Barbara Coast has been seeping oil into the area for a million years or more.

The literature thus abounds in information relating to the presence of hydrocarbons in living systems and the biological oxidation of hydrocarbons. It is unfortunate that there is so little information relating to the significance of the presence of the hydrocarbons in protoplasm and especially the aromatic and asphaltic hydrocarbons.

Submitted by:

Carl H. Oppenheimer
Director, University of Texas
Marine Science Institute at Port Aransas

June 7, 1971

-Composition of Extracts

Sample number	Depth in core (cm)	Depth *in situ* (cm)	Organic carbon (per cent weight dry sediment)	Per cent of total organic matter (1.7 x carbon) extracted	Grams organic matter extracted per 100 g dry sediment	Per cent paraffins and naphthenes	Per cent aromatics	Per cent asphaltics	Per cent extract remaining on alumina	Ratio of aromatics to paraffin-naphthenes	Ratio of asphaltics to paraffin-naphthene-aromatics
Santa Barbara Basin—Core 2622B, C											
1	0–8	0–16	3.75*	4.70	0.301	4.4	8.2	39.9	47.5	1.9	3.2
2	16–30	32–60	3.24	4.35	0.239	4.2†	7.2†	61.5	27.1	1.7	5.4
3	124–137	248–274	2.40	4.28	0.175	4.1	3.5	81.4	11.0	0.9	10.7
4	209–239	418–478	2.06	4.75	0.166	4.9†	7.2†	74.3	13.6	1.5	6.2
Catalina Basin—Core 2989											
5	0–30	0–60	3.63	2.28	0.141	0.7†	1.6†	52.8	44.9	2.3	23.0
6	30–74	60–148	3.66	2.22	0.138	5.6	5.0†	48.4	41.0	0.9	4.6
7	103–125	206–250	3.50*	1.55	0.092	1.2†	2.0	52.7	44.1	1.8	16.5
8	147–170	294–340	1.63	1.73	0.048	1.8	4.6	40.8	52.8	2.6	6.4
Santa Cruz Basin—Core 1941 (Smith, 1954)											
9	12–18	24–36	3.76	2.94	0.188	1.9	3.4	14.7**	80.0	1.8	2.8
10	137–152	274–304	2.91	2.97	0.152	1.9	16.7	17.9	63.5	8.8	1.0
11	198–221	396–442	3.36	2.61	0.149	2.6	8.4	27.4	61.6	3.2	2.5
Crude Oil, Los Angeles Basin—Domínguez Field (4775 feet) Lower Repetto Pliocene Age††											
12	.....	.....	.....	......	.....	41.8	18.9	17.5	21.8	0.45	0.3

* Two organic carbons from earlier cores

† Values uncorrected for sulfur

** Per cent asphaltic fractions are larger, and per cent remaining on alumina smaller in present work than in Smith's owing to difference in procedure.

†† Crude oil was topped at 56°C at 2 mm, as were the sediment extracts.

Table 1

Table 2

TABLE 1. *Hydrocarbons from algae.*

	Blue-Green Algae		Green Algae	
	Nostoc	*Anacystis*	*Spirogyra*	*Chlorella*
n-C_{15}	0.42	28	—	0.7
n-C_{16}	0.42	3.4	6.7	0.4
Pristane	—	—	22	—
Δ-C_{17}	—	4.0	—	450
n-C_{17}	100	100	100	100
Branched C_{18}	10.4	0.44	—	—
Phytane	—	—	15.5	—
n-C_{18}	0.5	—	58	0.3
n-C_{19}	0.4	—	62	0.1
n-C_{20}	0.4	—	22	—
Higher mol wt hydrocarbons	No	No	Less than 30% of total hydrocarbons	—
Major component	n-C_{17}	n-C_{17}	n-C_{17}	Δ-C_{17}

Peak heights are relative to n-C_{17} peak taken as 100.
Dash indicates less than 0.5 (n-C_{17} = 100).

TABLE 2. *Hydrocarbons from bacteria and yeast.*

	Photosynthetic Bacteria		Nonphotosynthetic Bacteria		
	Rhodopseudomonas spheroides	*Rhodospirillum rubrum*	*Micrococcus lysodeikticus* (anaerobic)	*E. coli* (aerobic)	Yeast
n-C_{15}	2	0.3	112	10	50
n-C_{16}	7	1.7	95	37	60
Pristane	22	3	55	—	
Δ-C_{17}	—	—	—	—	
n-C_{17}	100	100	100	100	100
Branched C_{18}	—	—	—	—	
Phytane	3	—	21	—	
n-C_{18}	44	10	58	700	500
n-C_{19}	43	13	147	210	450
n-C_{20}	8.8	9	53	200	1000
Higher mol wt hydrocarbons	Less than 5% of total hydrocarbons	Less than 15% of total hydrocarbons	More than 50% of total hydrocarbons	More than 60% of total hydrocarbons	More than 60% of total hydrocarbons
Major component	n-C_{17}	n-C_{17}	n-C_{19}	n-C_{18}	n-C_{20}

Peak heights are relative to n-C_{17} peak taken as 100.
Dash indicates less than 0.5 (n-C_{17} = 100).

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Table 3

Composition of Paraffins (%) in the Cuticular Waxes of Morphologically Distinct Parts of Several Plants of the Family *Papaveraceae*

Number of C atoms	Homologous series	*Papaver rhoeas* L.										*Papaver somniferum* L.	*Chelidonium majus* L.	*Dicentra spectabilis* (L.) DC.
		stem	leaves	leaves	sepals	petals	pistils	filaments	anthers	capsules	seeds	leaves	leaves	leaves
12	n				+		+				+			
13	n				+		+	+	+		+		+	
14	I				+		−	−	−		−		−	
	n	−	+	+	+	+	+	+	+		0·1	+	+	
15	II		−	−	−	−	−	−	−	+	−	−	−	
	I		−	−	+	+	+	+	−	+	0·1	+	+	
	n	+	+	+	+	+	+	+	0·1	+	0·3	+	+	+
16	II	−	−	−	−	−	+	+	−	+	−	−	+	−
	I	−	−	−	+	+	+	+	−	−	−	+	+	+
	n	+	+	+	+	+	0·1	0·1	0·1	+	0·6	+	0·1	0·1
17	II	−	+	+	−	+	+	+	−	+	0·1	+	+	+
	I	−	+	+	−	+	+	+	−	−	−	+	+	+
	n	+	0·1	+	0·1	0·7	0·1	0·2	0·5	0·1	4·2	+	0·1	0·2
18	II	+	+	−	+	−	−	+	−	−	−	+	+	+
	I	−	+	−	+	+	−	+	−	−	−	+	+	+
	n	+	0·2	+	0·1	0·1	0·1	0·2	0·4	0·1	3·3	0·1	0·1	0·2
19	II	−	+	−	−	−	−	+	+	−	−	+	+	+
	I	−	0·1	−	+	+	−	+	−	−	−	+	+	+
	n	0·1	+	0·1	1·2	12·8	1·0	3·6	9·4	0·9	62·8	+	+	0·2
20	II	+	+	−	−	−	−	+	−	−	−	+	+	+
	I	+	+	+	−	−	−	+	−	−	−	+	+	+
	n	+	0·2	+	0·1	0·6	+	0·2	0·9	0·1	1·9	+	+	0·2
21	II	−	−	−	−	−	−	+	−	−	−	−	+	+
	I	−	−	−	−	−	−	+	−	−	−	+	+	0·2
	n	+	0·7	0·4	2·3	19·6	0·5	2·3	4·5	1·0	11·5	0·1	0·1	0·3
22	I	+	−	+	−	−	−	−	−	−	−	−	+	−
	n	+	0·7	0·1	0·2	0·4	0·1	0·2	0·2	0·1	1·0	+	0·2	0·5
23	II	−	−	+	−	−	−	−	−	−	−	−	−	−
	I	+	+	−	−	−	0·2	0·7	2·0	−	0·1	−	+	−
	n	0·1	2·5	1·0	8·1	21·6	1·8	3·3	4·8	2·5	4·1	11·7	0·2	0·8
24	II	−	−	+	−	+	−	−	−	−	+	−	−	−
	I	+	0·1	+	−	−	0·4	1·1	3·6	−	0·2	+	+	−
	n	+	2·0	0·7	5·5	0·4	0·3	0·4	0·6	0·4	0·4	1·2	0·1	0·5
25	I	+	+	+	−	0·3	1·9	4·4	17·3	0·3	0·3	−	+	−
	n	0·2	5·3	7·8	24·0	8·8	8·1	4·0	4·3	9·4	1·5	56·6	0·2	1·9
26	II	−	+	+	−	−	−	−	−	+	0·3	−	−	−
	I	+	0·1	+	−	+	0·4	0·8	2·3	−	−	+	+	−
	n	0·1	2·5	0·8	0·9	0·3	1·3	1·0	1·0	1·2	0·2	0·7	0·2	0·6
27	I	−	0·6	+	−	0·4	4·7	7·5	24·4	0·4	0·5	−	−	−
	n	4·0	25·7	25·5	43·2	18·3	33·5	20·7	13·4	43·6	2·8	16·2	1·0	29·6
28	II	−	0·1	+	−	−	−	−	−	+	+	−	−	−
	I	−	0·4	+	−	−	−	−	0·4	+	−	−	−	−
	n	1·5	2·5	1·0	0·8	0·5	2·5	19·5	0·9	2·1	−	0·5	0·3	1·8
29	I	−	0·5	−	−	−	0·5	0·6	1·3	−	−	−	0·1	−
	n	92·2	41·7	49·1	13·8	11·3	40·1	24·9	6·8	36·9	3·9	11·4	22·7	61·6
30	II	−	0·8	−		−	−	−	−	−		−	−	−
	I	+	0·6	−		−	−	−	−	−		−	−	−
	n	0·4	0·9	0·3		0·3	0·6	1·0	0·3	0·3		−	1·2	−
31	I	0·7	0·6	−		−	−	−	−	−		−	−	−
	n	0·8	10·3	11·1		3·6	1·7	3·4	0·6	0·7		1·4	73·5	1·5
32	n		0·2	−									+	
33	I		+	−									−	
	n		0·5	2·1									+	
Dry weight of plant, g		19	15	110	90	236	111	21	52	165	220	20	111	6·6
% Alkanes per dry weight		0·15	0·027	0·034	0·082	0·49	0·022	0·072	0·13	0·013	0·0019	0·035	0·11	0·046
Collection month/year		VII 1965	VII 1965	VII 1967	VII 1965	VII 1965	VII 1965	VII 1965	VII 1965	IX 1965	IX 1965	VII 1967	VIII 1967	VII 1967

Table 4

Composition of Olefins (%) in the Cuticular Waxes of Morphologically Distinct Parts of Several Plants of the Family *Papaveraceae*

Number of C atoms	Homologous series	*Papaver rhoeas* L.									*Papaver somniferum* L.	*Chelidonium majus* L. leaves	
		stem[a]	leaves[b]	sepals	petals	pistils	filaments	anthers	capsules	seeds	leaves	*trans*-	*cis*-[c]
13	B				+								
14	A				−								+
	B				+	+						+	−
15	B				+	+	+	+				−	−
	C		+;		−	−	−	−				+	+
16	B		−		+	+	+	+				−	+
	C		+		−	−	−	−		+		0·2	+
17	A		−		−	−	−	−		−		+	+
	B		−	0·9	0·5	0·1	0·7	0·3	0·2	1·8		+	+
	C		+	−	−	−	−	−	0·1	−		0·5	+
18	A		−	−	−	−	−	−	−	−		0·2	+
	B		−	0·6	0·3	+	0·2	0·1	0·4	1·0		0·1	0·1
	C		0·1	−	−	−	−	−	−	−		0·5	−
19	A		2·3	3·8	−	+	−	−	0·2	−		−	−
	B	+	2·6	56·1	42·6	3·7	17·8	22·3	35·8	85·5		−	+
	C		0·5	−	−	−	−	−	−	−		0·2	−
20	A		−	−	0·1	−	−	−	−	−		0·3	−
	B	+	0·1	0·7	0·8	+	0·2	0·2	0·6	0·8		0·2	0·1
	C		0·2	0·1	−	−	−	−	+	+		0·3	−
21	A		+	−	−	−	−	−	−	−		0·1	−
	B	+	0·6	15·8	23·6	0·8	0·8	5·4	12·6	10·4		0·2	+
	C		1·3	0·3	−	−	−	−	2·2	−	0·1	0·2	−
22	B	+	−	0·1	0·4	+	+	0·1	+	+	−	0·1	0·1
	C		0·5	−	−	−	−	−	+	−	0·2	0·2	0·2
23	A		−	−	−	−	−	−	−	−	−	+	−
	B		11·1	3·6	4·6	0·3	0·9	0·8	2·5	0·4	0·3	0·1	0·1
	C		+	−	−	−	−	−	0·7	−	0·6	0·1	+
24	A	−	−	−	−	−	−	−	−	−	0·2	+	−
	B		−	−	0·1	−	+	+	0·1	−	−	0·1	+
	C	+	1·8	0·2	−	−	−	−	0·2	+	3·8	0·2	0·8
25	A		−	−	−	−	−	−	−	−	−	0·1	−
	B	+	3·8	0·5	0·7	0·1	0·2	0·2	0·3	+	1·6	0·3	0·3
	C		1·9	0·1	−	−	−	−	0·2	−	2·3	+	0·1
26	A		−	−	−	−	−	−	−	−	0·5	−	−
	B		−	−	+	−	+	+	−	−	−	+	+
	C	+	5·2	2·5	−	−	−	−	4·2	+	25·3	0·3	1·4
27	A		−	−	−	−	−	−	−	−	0·9	−	+
	B	+	8·0	0·5	0·6	0·7	1·0	0·9	0·6	0·1	3·7	4·7	4·5
	C	+	5·0	0·3	−	−	−	−	1·1	−	3·8	0·4	0·2
28	A		−	−	−	−	−	−	−	−	0·5	−	−
	B		−	−	0·1	+	0·1	0·1	−	−	−	0·2	0·1
	C	+	11·4	0·2	−	−	−	−	5·9	−	5·6	0·1	3·6
29	A		−	−	−	−	−	−	−	−	--	−	0·4
	B	+	27·0	3·8	5·3	35·0	24·9	25·3	15·7	0·1	42·3	87·0	81·6
	C	+	1·8	1·0	−	−	−	−	0·9		1·3	+	1·9
30	B		0·8	−	0·3	0·5	0·6	0·5	0·1		−	−	−
	C	+	0·9	−	−	−	−	−	−		0·6	+	1·7
31	B	+	10·7	8·0	16·6	56·7	48·9	41·2	15·7		6·5	2·1	2·3
	C		−	−	−	−	−	−			−	1·3	−
32	B		−	−	0·4	0·3	0·6	0·5			−		−
	C	+:	−	−	−	−	−	−			−		0·4
33	B		2·7	0·9	3·1	1·9	3·4	2·2			+		+
	C												+
% Alkenes per plant dry weight		traces	0·0017	0·011	0·27	0·016	0·063	0·16	0·0012	0·0023	traces-	0·0009	0·0006
% Alkenes in the hydrocarbon fraction		traces	5	12	36	42	47	54	9	55	traces	11	8

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[a] For lack of material, no quantitative analysis has been carried out. [b] Collection in July 1967. [c] Alkenes of the C series are probably terminal.

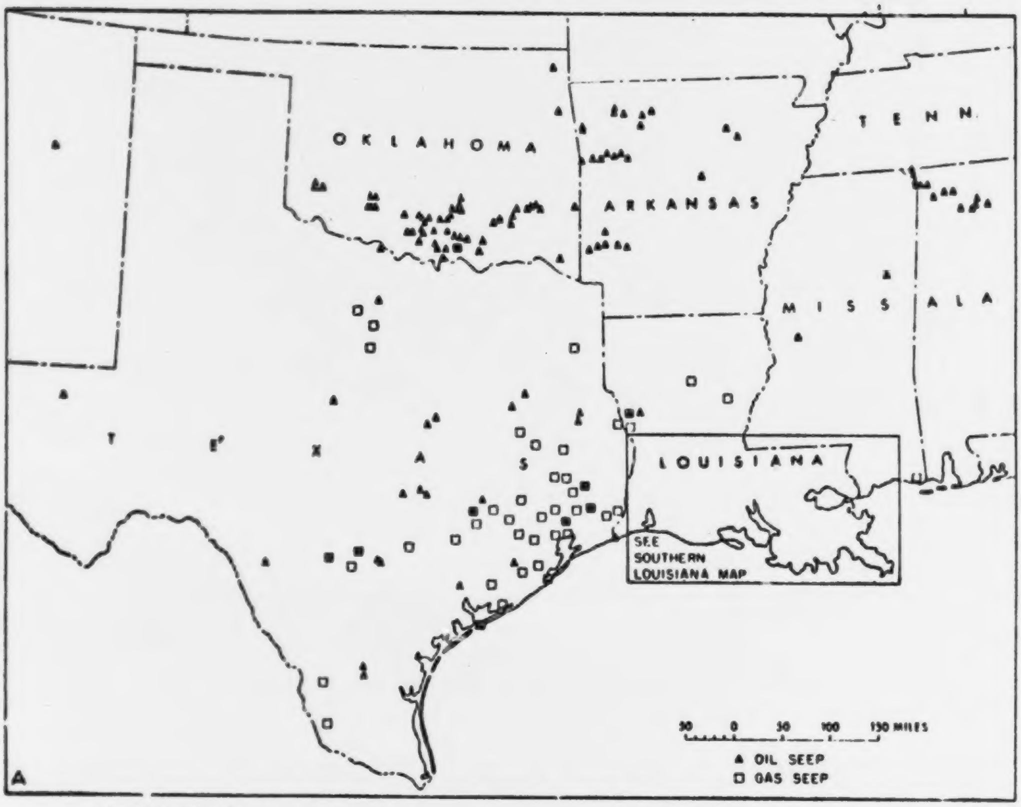
OKLAHOMA
ARKANSAS
TENN.
MISS
ALA
TEXAS
LOUISIANA
SEE SOUTHERN LOUISIANA MAP
50 0 50 100 150 MILES
▲ OIL SEEP
□ GAS SEEP
A

Fig.30A. Distribution of oil and gas seeps in southern United States.

Figure 1

Reproduced from best available copy.

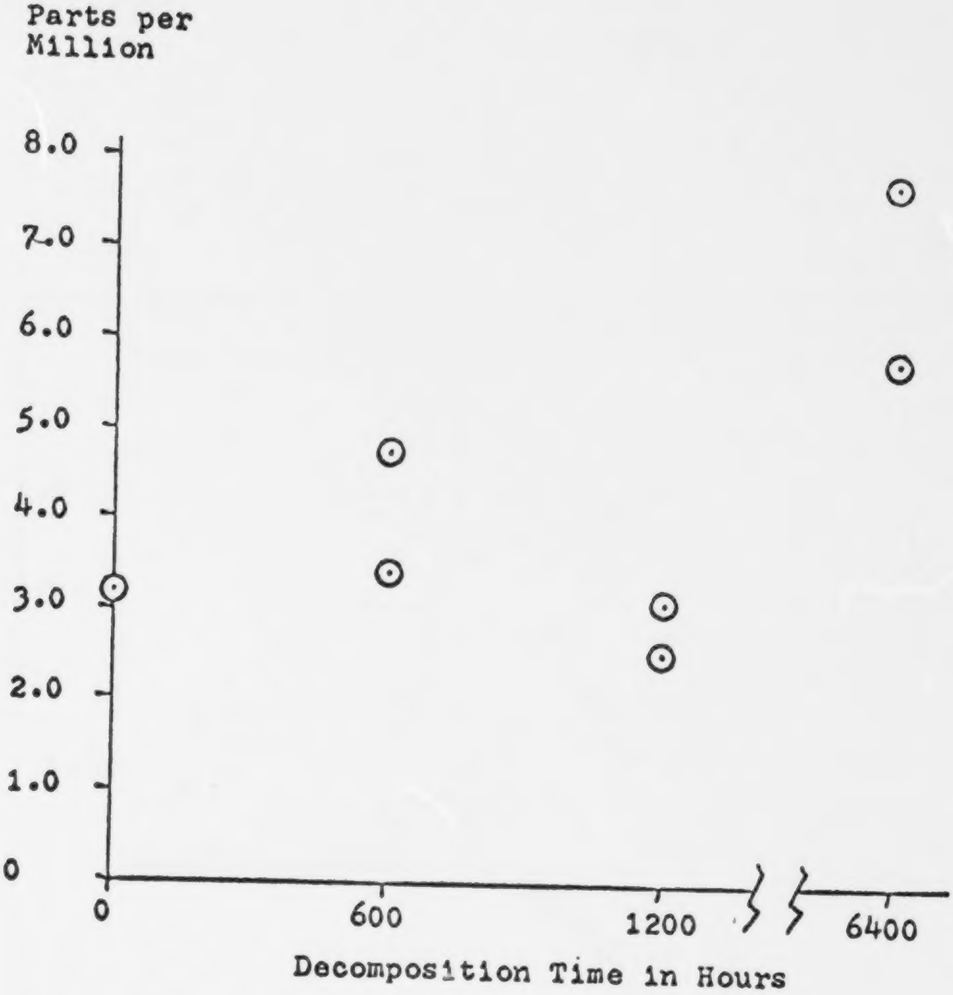

FIGURE 2.---The change in hydrocarbon content of the artificial sediment mixtures with time, expressed as parts per million of the dry sediment. Each point represents the analysis of a separate mixture. Note the break in the time axis between 1200 hours and 6400 hours.

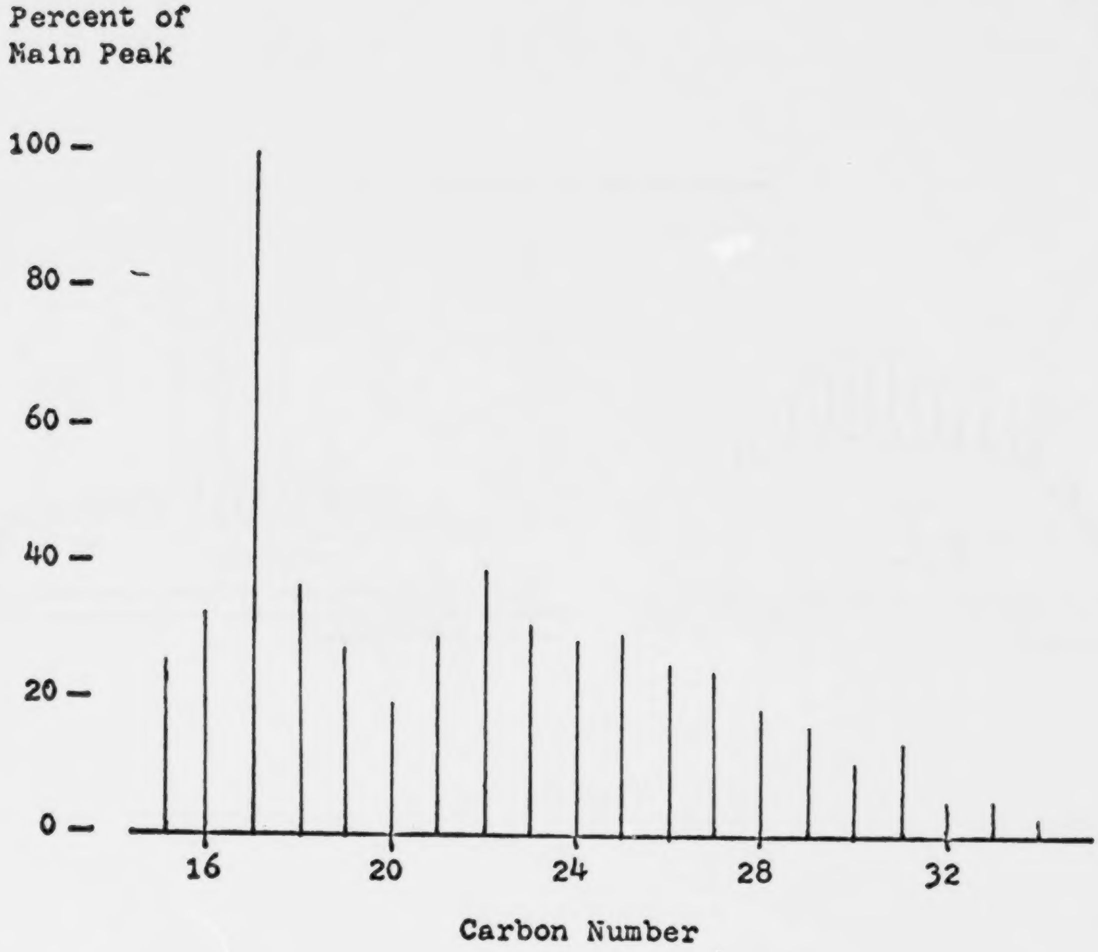

FIGURE 3.---A typical normal hydrocarbon distribution pattern. The height of each line represents the abundance by weight of the hydrocarbon relative to C-17. This data is for a 6400 hour sample; all of the other hydrocarbon fractions, with the exception of those mixtures containing added C-22 hydrocarbon, were essentially identical to this one.

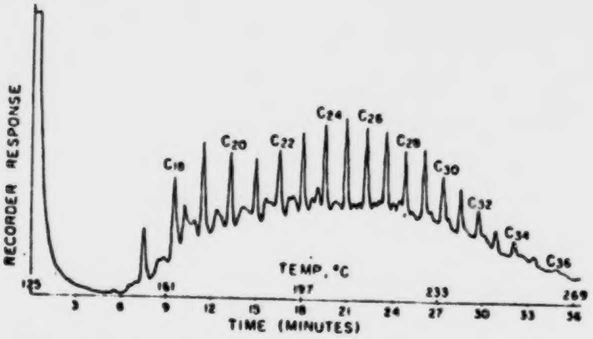

FIG. 1. Gas chromatographic separation of autotrophically produced *Chlorella vulgaris* hydrocarbons, programmed at 4°/min on a 3% SE-30 column.

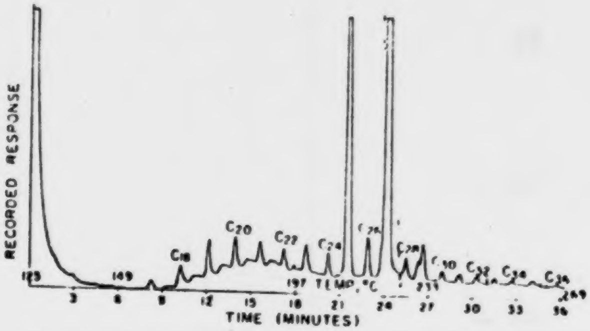

FIG. 2. Gas chromatographic separation of heterotrophically produced *Chlorella vulgaris* hydrocarbons, programmed at 4°/min on a 3% SE-30 column.

Figure 4

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MR. VANDERHOOF: Dr. Oppenheimer, are you describing crude oil spills or are you describing hydrocarbons from industrial waste?

DR. OPPENHEIMER: They are synonymous.

MR. VANDERHOOF: Tell me, then, is a pesticide a hydrocarbon?

DR. OPPENHEIMER: A pesticide is a hydrocarbon base, yes. On a strictly chemical description though it is not a hydrocarbon per se because it is not only hydrocarbon and carbon; it has had another metal added.

But most pesticides are hydrocarbon bases and so are detergents. Most detergents with long molecules that have the oil affinity consist of a hydrocarbon and many other materials.

MR. VANDERHOOF: Are you saying any industrial waste that has hydrocarbons is not offensive? It can be degraded?

DR. OPPENHEIMER: No, I didn't say that. No. All I said was that there are hydrocarbons produced in natural living organisms that are synonymous with the wide range of molecules that we find in crudes. I am also saying most crude oils are produced originally by biological systems. Therefore, we have to be very careful in determining where toxicity exists in that it might overshadow some other points that we are overlooking.

There is none to my knowledge, but I have not made an exhaustive survey of the literature. As I have already indicated to you, I have not found a reference in which it has been definitely proven to my satisfaction with experimental results that hydrocarbons are toxic. There may be a case, but there may be many other things too that are also part of the same system that could be just as toxic -- such as oxygen concentrations.

MR. VANDERHOOF: Have you looked into secondary effects, for instance? For instance, you apparently don't believe there is great damage due to oil on the surface. Have you looked into the variation capabilities of streams in loss of variation from the coating of oils?

DR. OPPENHEIMER: No.

That is not a part of my discussion here at all. That is purely physical. We are working on that too, but it is another aspect using living organisms to clean up surface oil spills.

We are interested in the toxicity of byproducts of course, but so far we have found none.

MR. VANDERHOOF: Don't you suppose we ought to err on the side of safety?

DR. OPPENHEIMER: Well, it depends on concentrations. If your concentrations are to the point where they are going to be mechanically disabling, yes, then we should go to mechanical contrivances such as I mentioned, passing suitable laws to restrain or restrict the major oil spill. But here again, you have got 2-cycle engines going all over the place.

A small lake after a weekend of skiers will have a scum of oil from the combustion engines clear around the lake, especially on the Rayburn Lake. I happen to live on one, so I can say for sure.

Perhaps we should abolish the 2-cycle engine tomorrow. This would cut down on a tremendous amount of oil pollution.

CHAIRMAN STEIN: All right.

MR. YANTIS: For the Texas Wildlife and Parks Department, Mr. Terrance Leary.

Mr. Leary is the Coordinator of Coastal Fisheries. He is a marine biologist and he will speak to the "Occurrence and Value of Oysters in the Galveston Bay System."

MR. TERRANCE LEARY
COORDINATOR OF COASTAL FISHERIES
TEXAS PARKS AND WILDLIFE DEPARTMENT
AUSTIN, TEXAS

MR. LEARY: Mr. Chairman, conferees, ladies and gentlemen. I have some slides. Perhaps we could dim the lights.

The Texas Parks and Wildlife Department is the agency charged with the responsibility for managing the fish, wildlife, and public outdoor recreation resources of this State. Included, of course, are the fishery resources of Galveston Bay, the most productive of our bay systems.

[Slide.]

Last calendar year, some 147,000,000 pounds of marine products were landed in Texas, of which approximately 34.5 million pounds were landed in the Galveston Bay area. Discounting the 43,000,000 pounds of menhaden, an industrial fish sought only in our easternmost county, 1/3 of the fishery landings were made in our Galveston District, comprising the greater Galveston Bay system and associated offshore waters. Galveston Bay also produces about 90 percent of our Texas oysters, and most of this production is centered in a relatively small area in the central portion of the bay.

Our department has some 23 marine biologists serving in our Coastal Fisheries function, of whom 6 are headquartered and work in the Galveston Bay System. The chemists are assigned to pollution surveillance and bioassay studies. Additionally, some 12 game management officers are stationed in the counties bordering Galveston Bay.

Our biologists, and as far as I know we are the only agency aside from the State Health Department surveying oyster reefs in the bay, inform us at the present time we have approximately 8,000 acres of oyster reefs in the Trinity, Galveston, West and East Bay system. Not all of these reefs, however, have sufficient oyster production to provide a fishery. Some have very few, if any, live oysters. Some are located in portions of the upper bay subject to periodic flooding by freshwater, which kills the oysters before they reach commercial size.

It is the responsibility of the State Health Department to classify shellfish producing waters in a cooperative program with the Food and Drug Administration and our department.

Some 47 percent of the total water area of the Galveston Bay system is closed to oyster production. However, only 1,500 acres, or 19 percent, of the total oyster bottoms are located in the closed area. Of these, approximately 500 acres, at most, could be considered as productive and less than 1/2 of these would be fished by commercial fishermen should they be opened today. Thus, we are talking about 250 acres of potentially productive reefs now located in waters of the Galveston Bay System in the closed areas. They are not, however, entirely lost to the fishery.

Under a closely supervised program, our

department, with the approval of the State Health Department, issues permits for the relaying of oysters from these areas to private leases in approved areas. This process of relaying consists of transplanting oysters from closed areas to the approved areas where they are held for a sufficient period of time to render them safe for consumption. Thus, any oysters relayed from the 250 acres of productive but closed reefs are utilized by private lessors and are restored to true productivity.

The procedure of relaying must be carefully differentiated from depuration, a costly process not used in this State. In depuration, oysters from polluted areas are held in man-made tanks while artificially purified sea water is circulated over them for a period of cleansing. Depuration is expensive while relaying is very inexpensive. In fact, almost all of the oysters produced commercially in the State of Louisiana have been transplanted from seed beds to private leases, a process exactly like relaying.

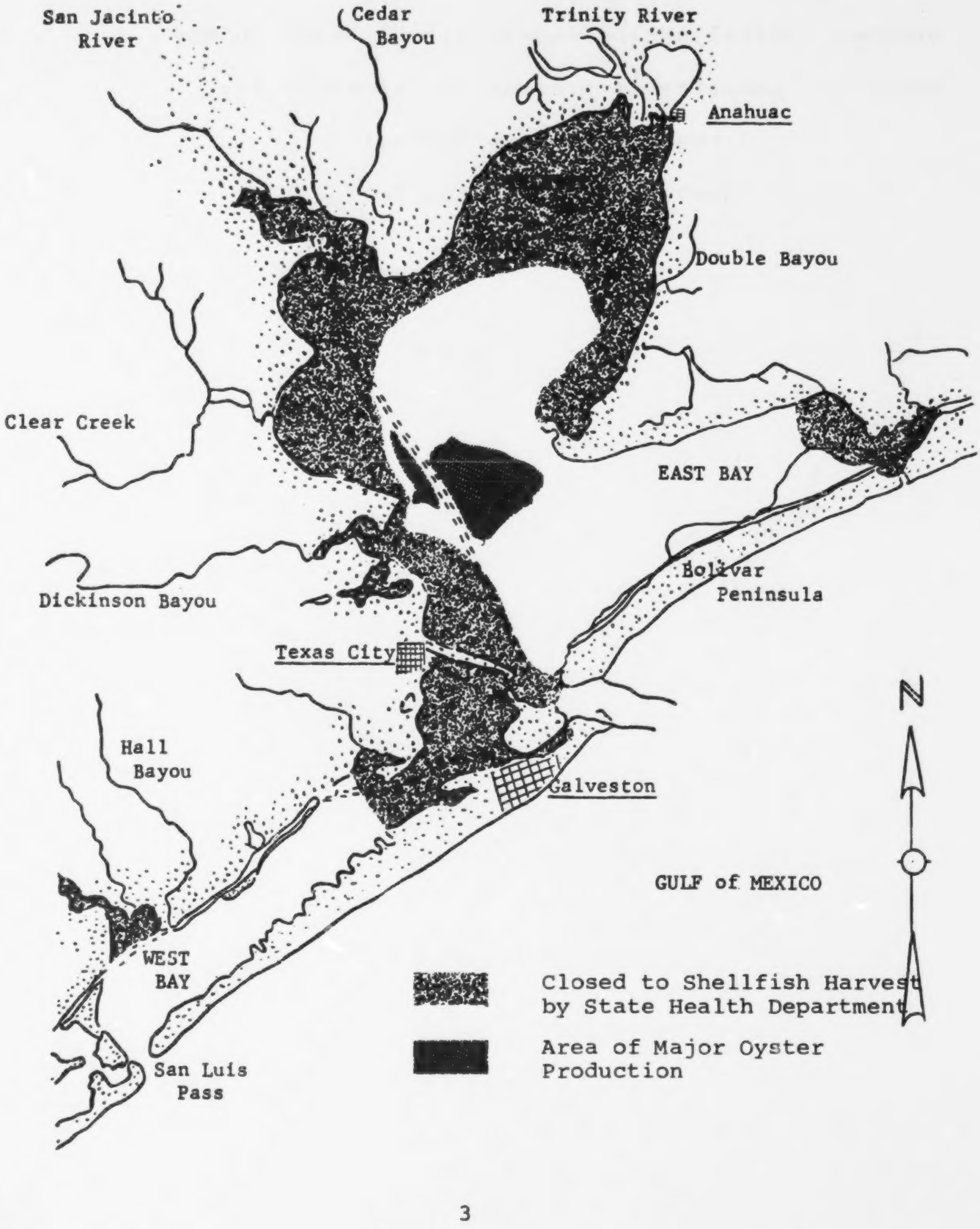
I would estimate the annual production value of those now potentially productive reefs located in closed areas, if we valued them at $60.00 per acre, would be about $15,000 per year -- that's the dark side. From this figure must be subtracted the value of the relayed oysters salvaged by the private resources.

It should be obvious that our oyster industry has not yet been devastated by pollution. The Food and Drug Administration apparently agrees, since its annual appraisal of the Texas State Shellfish Sanitation Program rated the program at 95 percent for the year ending June 1970. This is not to say, however, that we consider pollution lightly nor that we concur or approve of the conditions as they now stand. We do believe there is a need for improvement and we are assisting the Water Quality Board in upgrading standards for the waste discharge permits throughout the State. We are confident that the shellfish sanitation program in Galveston Bay as administered by the State Health Department and our department in cooperation with the Food and Drug Administration provides the consumer with a thoroughly wholesome product. The establishment of any new or unusual Federal action should not be based on the shellfish industry or program in Galveston Bay.

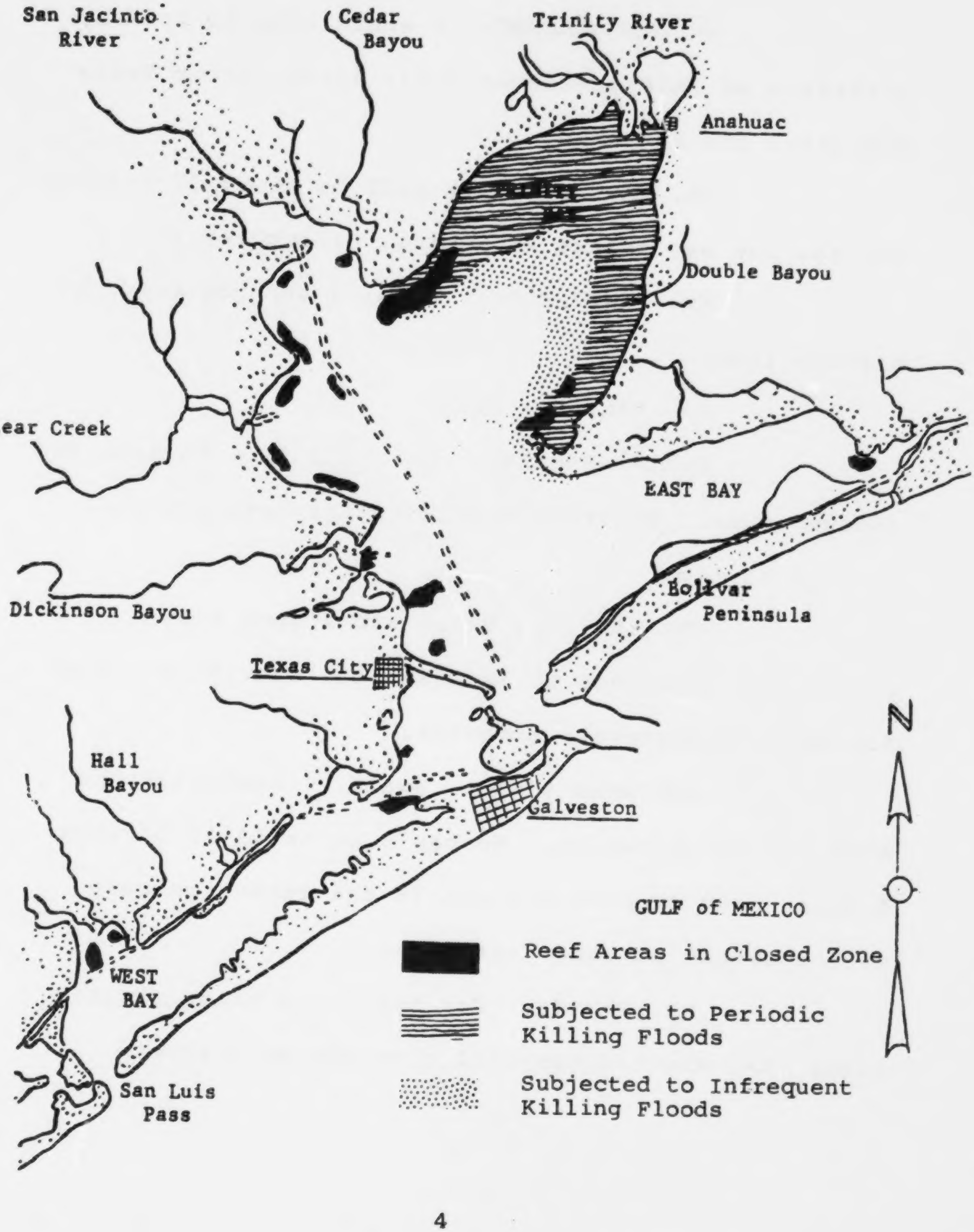
I thank you. (Applause.)

[Above-mentioned maps follow.]

OYSTER PRODUCING AND CLOSED AREAS OF THE GALVESTON BAY SYSTEM


San Jacinto River
Cedar Bayou
Trinity River
Anahuac
Double Bayou
Clear Creek
EAST BAY
Dickinson Bayou
Bolivar Peninsula
Texas City
N
Hall Bayou
Galveston
GULF of MEXICO
WEST BAY
San Luis Pass
▨ Closed to Shellfish Harvest by State Health Department
■ Area of Major Oyster Production

REEFS AND FLOODING IN CLOSED ZONE


San Jacinto River
Cedar Bayou
Trinity River
Anahuac
Double Bayou
Clear Creek
EAST BAY
Dickinson Bayou
Bolivar Peninsula
Texas City
Hall Bayou
Galveston
GULF of MEXICO
WEST BAY
San Luis Pass
N
■ Reef Areas in Closed Zone
▤ Subjected to Periodic Killing Floods
░ Subjected to Infrequent Killing Floods

MR. VANDERHOOF: I would like to hold my questions of this gentleman until later, after Texas completes its statement.

MR. YANTIS: That will be about 10 o'clock tonight the way things are going. (Laughter.)

MR. VANDERHOOF: We will see you tomorrow morning then.

MR. YANTIS: Okay.

CHAIRMAN STEIN: I should like to make an announcement. We are not holding this conference after 5:00 p.m.

MR. YANTIS: There are a good many industries here, and it is essential that they finish for other commitments tomorrow.

CHAIRMAN STEIN: Again, I would like to make the announcement. We can't go until 10 o'clock. I think 5:00 or 6:00 o'clock is the latest because of the extent of human resources.

MR. YANTIS: For the Texas Water Quality Board, Mr. Whittington will give you an analysis.

MR. DICK WHITTINGTON
TEXAS WATER QUALITY BOARD
AUSTIN, TEXAS

MR. WHITTINGTON: Thank you, Mr. Yantis.

Mr. Chairman, members of the conference panel, ladies and gentlemen. My presentation this afternoon is dependent upon slides, and with your permission I would like to get the lights dimmed.

First of all, I would like to talk about the problem. The Galveston Bay complex includes 14 water quality zones for which water quality requirements, commonly called stream standards, have been adopted by the State and accepted by the Federal Government. Some of these zones were out of compliance when the Texas Water Quality Board was established, and they have not yet been brought into compliance.

These zones are: 1) The Houston Ship Channel zones and the San Jacinto River Tidal Zone which are out of compliance with the oxygen resources parameters, 2) the Clear Lake Zone which is also out of compliance with oxygen resources parameters, although less severely and frequently than the Houston Ship Channel, 3) Upper Galveston Bay West of the Ship Channel is over a portion of its area noncompliant with respect to dissolved oxygen and bacteriological quality, and finally, 4) portions of Trinity Bay are noncompliant relative to bacteriological quality.

The fact that these zones are noncompliant with the water quality requirements does not necessarily mean that a real water quality problem exists. Those of you who have read the EPA report will recall that the incongruity of having a lower BOD criterion for Zone 0906 of the Houston Ship Channel than for Galveston Bay, Zone 1104, was pointed out.

Further problems of this nature can easily be noted. Zone 0906 of the Houston Ship Channel has a lower MPN than Galveston Bay, Zone 1104.

[Slide.]

The dissolved oxygen concentration established for the Gulf of Mexico at Galveston is 115 percent of saturation at the salinity and temperature which sometimes exists -- a standard physically impossible to meet. The BOD criterion for the Gulf at Galveston is 1 mg/l, well below normal gulf water. The average from samples which we have tested from all along the coast is 2.1 mg/l, as shown on this slide.

These problems point out the basic lack of scientific validity in all instances of the water quality requirements. In pointing out this lack, I do not intend to criticize either the State who prepared the requirements nor the Federal Government who accepted them. It must be remembered that the requirements were prepared by the State at the insistence of the Federal Government in a very short time by a very few persons. The requirements were undoubtedly accepted by the Federal Government under the same handicap.

The point here is that the requirements should be viewed as what they are, i. e., a generally sound guideline for water quality management. They should not be viewed as sacred, rigid, unchangeable requirements possessing great scientific validity and social worth. (Laughter.)

Now, I would like to talk to you a little bit about the attitude of our board.

Nevertheless, it is the view of the Texas Water Quality Board that the zones pointed out previously in this paper as being out of compliance with the requirements are real problems and not idiosyncrasies of the requirements. These problems were existent when the Texas Water Quality Board was created in 1967. They are not new.

Regardless of this, the board has not and is not satisfied with the status quo. We feel and have felt since the agency was formed that the situation is intolerable and that these problems must be corrected. Toward this end a corrective program was formulated and placed into motion. I would like to briefly discuss with you this corrective program.

First I would like to talk to you about the corrective program on the Houston Ship Channel and the San Jacinto River Tidal Zone. The problem in the Houston Ship Channel is caused by large volumes of both municipal and industrial waste being discharged into a deep, relatively narrow, artificial, altered channel which receives very little freshwater inflow and very limited tidal flushing -- both the hydrology and the geometry of the channel mitigating against its ability to assimilate wastewater.

The problem in the tidal reach of the San Jacinto River is related inasmuch as this problem is primarily due to the diffusion of pollutants up the river because of the very limited, practically nonexistent freshwater inflow. It was and is obvious that the first step toward a solution to the water quality problem in these zones is to lower the waste load -- although additional and/or different approaches may be and quite likely will be required before a truly satisfactory solution has been found.

With respect to lowering the load, this graph shows the decrease in the measured BOD load being discharged into the Houston Ship Channel since 1968. The data shown for 1968, 1969, and the first portion of 1970 are the BOD loads as determined by our district office from single measurements at each source. The data for the latter portion of 1970 and 1971 were calculated by months, using a digital computer and the self-reporting data supplied by each waste discharger pursuant to board order No. 69-1219-1.

The board order adopted by the board on April 14, 1970, requires each waste discharger holding a waste control order from the board to report monthly on the volume and quality of wastewater discharged during the month. In the case of larger discharges, continuous flow measurements and analyses on composite samples are required. As a consequence, these data are considerably more accurate than the earlier single measurement data as secured by us in our district office. The last calculation shown on this graph is the load existent as of April 1971.

Also shown on this graph is a 1970 estimate of the total raw waste load. It should be remembered in viewing this graph that the raw waste load prior to treatment has and will continue to increase with time, due to the population and industrial growth of Houston. The decrease has been effectuated in spite of the growth in the raw waste load.

Additionally, the treated BOD load, authorized by waste control orders issued by the Texas Water Quality Board as of April 1971, is shown, and it happens to coincide exactly with the actual load. You will note from this graph that a considerable decrease has been effectuated, the aggregate BOD load discharged to the channel is less than that authorized, and that an overall BOD removal of about 76 percent is being realized. This progress was not achieved miraculously; it was achieved by both municipalities and industries spending large sums for treatment works.

I would like to show you some pictures of these waste treatment works. These pictures are of plants which were constructed prior to 1968 when our first measurements of the waste load into the channel were made.

This is a picture of the city of Houston's Sims Bayou plant. It discharges into Sims Bayou, thus into the Houston Ship Channel. This is an activated sludge plant which has a capacity of 48,000,000 gallons per day. Presently there are no chlorination facilities at this plant. I was informed today that the Public Works Department of the city of Houston has gotten their plans approved for the installation of such facilities at this plant. They have gotten their grant approved, and they have gotten their funding ready, and they are proposing momentarily to request permission from the city commissioners to take bids on the installations.

This is a picture of the waste treatment facilities belonging to the Southland Paper Company. This facility uses the activated sludge process and discharges into the Houston Ship Channel. This is the case even though you can see the San Jacinto River in the upper righthand corner of the picture.

[Slide.]

This is a picture of the Stauffer Chemical Company Manchester Plant. This plant manufactures sulphuric acid, alum and bone char.

The wastewater generated by this facility is of an inorganic nature. Ponds noted in the lower center of the photograph are for the company's neutralization and clarification facilities.

[Slide.]

This is a picture of the waste treatment plants serving Petro-Tex Chemical Corporation. This company manufactures butadiene, among other things.

Most of the products are utilized by other industries in the area for the manufacture of synthetic rubber.

In the center foreground of the picture you will note the area of the lagoon and clarification facilities. Please note the size of these facilities relative to the chemical plant and the automobiles located in the parking lot at the top of the picture.

The effluents from this plant discharge into Sims Bayou and then into the Houston Ship Channel.

In 1960, additional waste treatment facilities were constructed on the Houston Ship Channel. These facilities have an aggregate capacity to remove BOD from raw waste, as is shown on this photograph by the arrow on the right and the red line.

I would like to show you a picture of some of these waste facilities.

[Slide.]

This is a picture of the waste treatment plant serving Rohm & Haas at Deer Park. This is one of the largest secondary waste facilities on the Houston Ship Channel. Note the size of the aerated lagoon and the number of surface areas. Also please note that the facility incorporates into its design a trickling filter.

[Slide.]

Here are the waste treatment facilities serving the E. I.du Pont plant located adjacent to La Porte. The facilities are pretreatment facilities and the effluents from these facilities are conveyed by conduit to a basin consisting of an aerated lagoon with a quiescent area.

[Slide.]

This is a picture of the additional facilities provided by du Pont An idea of the size of this unit can be secured by comparing it with the size of the automobiles parked on the left adjacent to the outfall in there.

In 1969 additional waste treatment facilities were constructed on the Houston Ship Channel. These facilities have an aggregate capacity to remove BOD from raw waste, as shown on this photograph by the arrow on the right and the red line.

I, again, would like to show you a picture of these waste treatment facilities.

D. Whittington

[Slide.]

This is a picture of the facilities serving the Humble Oil Company complex at Baytown.

In the center of the picture is an aerated lagoon which discharges to a stabilization pond, pictured on the lower righthand corner of the photograph. Note the biological standpoint. Also, please note the size of both the aerated lagoon and stabilization pond relative to the tank farm in the background and the ship.

[Slide.]

This is another shot of the Humble facilities showing the aerated lagoon and an additional stabilization pond in the upper righthand corner up in here (indicating). The effluents from this plant are discharged right there (indicating). Note also you have heard lots of comments on Morgan Point. This is Morgan Point right there (indicating).

[Slide.]

This is a picture of the treatment facilities at the Upjohn Company. This waste treatment plant consists of neutralization facilities and an aerated lagoon followed by a pond area. Note additional waste treatment facilities on the lefthand edge of the picture which are being constructed for plant expansion. It will be noted waste treatment had 1/5 of the land area of the total plant.

In 1970 additional waste treatment facilities were constructed on the Houston Ship Channel. These facilities have an aggregate capacity to remove BOD from raw waste, as is shown on this photograph by the arrow on the right and again the red line.

I want to show you some more pictures.

[Slide.]

These are pictures of the waste treatment plant showing Shell Oil Company's Deer Park Refinery. Please note the size of the trickling filter relative to the large storage tanks in the foreground. I was informed out here in the hall a minute ago by Mr. Gene Smith of the Shell Oil Company that the average BOD for the last 3 months from this facility has been 11. The average total suspended solids, 16.

[Slide.]

Here are the waste treatment facilities

serving the Shell Chemical Company's Deer Park Works.

In the upper righthand corner of the photograph are located the pretreatment works. Right here (indicating). The sludge handling facilities are right here (indicating). In the center of the picture are aeration tanks. On the lefthand side of the picture are the final clarifiers.

[Slide.]

This is another shot of the same facility.

[Slide.]

This is a picture of the waste treatment facilities for Atlantic Richfield. In the lower center of the picture are located the API separators. In the center of the picture the aeration basin is located. This waste treatment facility consists of oil separators plus biological treatment.

[Slide.]

This is a picture of Charter International, formerly Signal Oil and Gas.

The waste treatment plant consists of oil separation right there (indicating) and equalization basin right here (indicating) and chemical precipitation right here (indicating) followed by biological treatment.

[Slide.]

This is a picture of the waste treatment facilities belonging to the Lubrizol Corporation. Note the aeration basin in the center of the picture. This facility provides biological treatment for wastes generated from the manufacturing of adhesives for oil and gas lines.

[Slide.]

This is a picture of U. S. Steel showing its waste treatment and manufacturing plant. The waste treatment plant is located in the upper righthand corner of the picture and consists of a neutralization treatment siltation basin. Note the aerated lagoon and settling pond. This plant is so constructed that all waste generated, including spillage from loading and unloading operations, is relayed through the treatment plant prior to its release to the environment.

In 1971 to date, additional waste treatment facilities have been constructed on the Houston Ship Channel. These facilities, again, have an aggregate capacity to remove BOD from raw waste as is shown on the graph.

Again, I want to show you some more pictures.

[Slide.]

This is a picture of the brand new waste treatment plant serving U. S. Plywood-Champion Paper Company. This facility provides biological treatment to waste generated in the manufacture of kraft paper.

[Slide.]

This is a photograph of the Arco Chemical Company's Channelview plant. In the center you will see the aeration basin. This facility provides a high level of biological oxidation and discharges into the San Jacinto River, then into the Houston Ship Channel.

[Slide.]

This is a picture of the Rico Chemical Company. This plant discharges into Greens Bayou, then into the Houston Ship Channel.

[Slide.]

This is a picture of the sewage treatment plant serving the city of South Houston.

This is a 1 MGD facility and utilizes a contact stabilization process plus chlorination.

I would point out that the white building in the center of the picture here houses incineration facilities for the disposal of sludge generated at the waste treatment plant, as well as household refuse generated within the city. This plant discharges into Berry Bayou and then into the Houston Ship Channel.

In addition to the facilities which I have just shown you, I would like to show you a few more pictures of facilities which will be completed this year and which will further reduce the BOD load to the Houston Ship Channel.

[Slide.]

This is a photograph of the 20 MGD expansion to the city of Houston Northside sewage treatment plant.

The expansion is located on the righthand side of the picture and you will note that facility was in partial operation at the time this picture was taken several weeks ago. This expansion will provide chlorination facilities for the entire design capacity of the total plant, some 60 MGD.

I was just informed by my colleague, Mr. John Lusler, District Superintendent for this District, that 23 MGD of waste treated by this plant was supposed to receive chlorination by noon today, and it is anticipated -- (Laughter) -- that the entire flow will be treated by the end of the week, which we never did get back in touch with these fellers to be sure they made it.

[Slide.]

Pictured here is the city of Houston's Southwest plant. Note that the facility was being expanded at the time the picture was taken. The aeration tanks in the foreground are in operation. Those in the background have just been constructed.

Note that room has been allowed for further expansion of this facility. This facility, which is presently under construction, is a new waste treatment plant for Diamond Shamrock's Greens Bayou plant.

[Slide.]

This picture is of a new waste treatment facility constructed by the Rollins Corporation.

This company is not in the manfacturing business; it is rather a company which retains materials from waste generated by other industries in the area, as well as providing a treatment service for difficult-to-treat wastes generated by others.

These are all of the pictures of waste treatment facilities located on the Houston Ship Channel watershed which we will show you today.

We would, however, like to show you a picture of U. S. Steel Corporation's new plant located in Chambers County adjacent to Galveston Bay.

[Slide.]

The area in the center of the picture had been dedicated for the provision of waste treatment facilities and other necessary utilities. This will greatly facilitate proper waste management as the steel plant is expanded.

[Slide.]

This is a picture of the waste treatment facility serving the Bayport Industrial complex.

This facility for waste treatment was

generated by 14 industries located in the complex. It is a regional industrial waste treatment plant.

Along these lines the Gulf Coast Waste Disposal Authority will be discussing further today additional plans for regional industrial waste treatment facilities.

I think you must, from the data which I have shown you, agree that the Texas program is effectuating a rapid -- I would say spectacular -- decrease in the BOD load being discharged. This has been accomplished with a minimum of cost to the citizens of the State of Texas, and very little unnecessary interference with our local governments and industries. Such a program is possible only where reason prevails.

Similarly, other pollutants such as COD and total suspended solids have been lowered, although we have not documented their decrease as we have in the instance of BOD. The situation which existed as of April 1971 is as shown in this table. You will note in each case that the actual discharge is less than that authorized by waste control order.

D. Whittington

I would like to briefly leave the Houston Ship Channel and talk about some of our other problems, specifically the problem which exists in Upper Galveston Bay west of the Ship Channel.

There are low dissolved oxygen values and high BOD values in spots, primarily near Morgan Point. Also, as you obviously know by discussions here today, higher than acceptable bacteriological densities exist at times.

The BOD and dissolved oxygen problems will be corrected when the Houston Ship Channel problem is solved.

The bacteriological quality problem in Upper Galveston Bay west of the Ship Channel is due to bacteria derived from three sources: 1) treated but not properly disinfected domestic sewage, 2) land wash, i. e., rainfall runoff from contaminated areas, and 3) waste discharges from ships and other vessels. The percentage of the problem attributable to each of these sources is not known, but it is quite likely that the first two sources, i. e., treated sewage and land wash are the more important.

Progress is being made in bringing about proper disinfection of the treated domestic sewage discharges in the Galveston Bay area. During February 1971, the chlorination practices at the sewage treatment plant located on the Houston Ship Channel were as shown in the table. Incidentially, this table was, in the first column, referring to the number of plants, and the percentage of plants, and then the volume, and the percent of the volume was over on the righthand side.

You will note at that time, of the 190 MGD of treated sewage being discharged, 24 percent of the volume was properly chlorinated; 21 percent of the volume was chlorinated but not totally satisfactorily. By this I mean that at least once during the month the chlorine residual was not adequate; 54 percent of the volume was not chlorinated; and we have no data for 1 percent of the volume.

I am happy to report, as I said previously, that the city of Houston chlorination facilities at their Northside sewage treatment plant will be on stream and will chlorinate some 60 MGD of the presently unchlorinated flow by the end of the week. With the advent of chlorination at this plant, the plants where chlorination is practiced will increase to 74 percent with 72 percent of the effluent discharged being chlorinated. Something is wrong with my figures here, but, anyway, 72 percent of the effluent discharged is connected up.

Further improvements are forthcoming. Again I told you that the city of Houston is going to let bids in the immediate future for chlorination facilities at the Sims Bayou plant. It is anticipated these facilities will be "on stream" by early 1972. When this is accomplished, all of the sewage treatment plants located on the Houston Ship Channel of which the Texas Water Quality Board has knowledge will have the required facilities for proper disinfection. The securement of proper chlorination then resolves itself to one of providing adequate surveillance and enforcement to insure that the facilities provided are used. This, the board intends to do.

In the Clear Lake watershed approximately 85 percent of the plants are properly chlorinating, as revealed by duplicate inspections conducted during February, March, and April 1971. All of the plants are equipped with the required facilities. The additional inspection frequency, which we plan on inaugurating when our staff is expanded at the beginning of our upcoming fiscal year, should increase the 85 percent proper operations.

In the past, problems have been noted in the bay adjacent to the city of Galveston main sewage treatment plant. This problem is illustrated in Figure V-3 of the EPA report. Figure V-3 is based on data secured during the periods December 1968 -- April 1969, and December 1969 -- April 1970. Since these data were collected, a considerable improvement in the situation at Galveston has been effectuated. We would hasten to add at this point that the problem has been improved -- not yet totally corrected. The city, however, during recent months, has been able to provide proper chlorination for its waste discharge.

Insofar as the water quality problems in Upper Galveston Bay west of the Ship Channel are concerned, I would repeat that the dissolved-oxygen-related problems will be solved when the load on the Houston Ship Channel is adequately lower. Further, with the advent of the city of Houston placing the chlorination facilities at the Sims Bayou treatment plant into operation, an event scheduled for early 1972, it is our view that a major -- and I would repeat this -- improvement in the average bacteriological quality situation in the bay will materialize. We do not know if this improvement will be sufficient to avoid high coliform densities in portions of this zone of the bay during periods of significant rainfall runoff where land wash is a major influence.

I would now like to leave the Galveston Bay and go to Trinity Bay. Trinity Bay, prior to the advent of the Houston Lighting & Power Company's Cedar Bayou generating station, received no large wastewater discharge of any kind. Nevertheless, portions of Trinity Bay have for many years been noncompliant with the bacteriological requirements. This is difficult to understand inasmuch as the bay receives no direct point waste discharges of any magnitude. In fact, the periphery of the bay is almost totally undeveloped, having only 4 small communities on its banks -- Anahuac with a population of 1,986, Beach City with a population of 200, and Smith Point here, and Oak Islands with population too small to be included in the Texas Almanac. (Laughter.) All of these communities utilize septic tanks at the moment for sewage disposal.

It is our judgment that the problem here is related to land wash and wastes from diffuse sources -- certainly not point waste discharges. An examination of the percentage of fecal coliform organisms at various MPN values is indicative of this fact. You will note that the higher the MPN the lower the percent fecal organisms. Normally for a fresh sewage discharge you should have a fecal percentage something in the order of 35 to 40 percent. This indicates that these organisms are largely derived from land wash. The solution to the bacteriological quality problem in the portions of Trinity Bay affected is unclear. The experience in Trinity Bay, however, would tend to question the view that the problem in Upper Galveston Bay west of the Ship Channel is totally related to point discharges of treated sewage.

Now I would like to go to Clear Lake. The problem in Clear Lake is one, as you already know from being here yesterday, of eutrophication. In order to cope with this problem, the board adopted on August 28, 1970, board order No. 69-9A requiring tertiary treatment for all waste in the watershed by August 28, 1972.

It is our belief that the increased treatment level required by this board order, plus the heightened surveillance and enforcement of the law as it relates to waste spills on the watershed, will bring the zone into compliance. Increased surveillance and enforcement will be possible during our next budget year since we will more than double the size of our district office.

Now, I would like to leave specific problem areas and talk in general terms. The EPA report concerns itself with oil and grease and heavy metals in Galveston Bay as these pollutants relate to seafood, particularly shellfish.

According to the EPA report, outstanding waste control orders issued by the Texas Water Quality

Board authorize the release of 55,000 pounds per day of oil and grease into Galveston Bay, of which 98 percent is authorized for release to the Houston Ship Channel. Further, the EPA report recommends that the "permits should be amended to allow no discharge of oil and grease from any waste source," and states that the permitted discharge of oil constitutes a violation of Section 11(b) of the Federal Water Quality Act, as amended.

The recommendation is ridiculous in that "all" is a meaningless term as applied to water quality control. If you are able to make a test for a particular pollutant sensitive enough, you will almost invariably find the pollutant in any sample of wastewater. Water is, after all, the universal solvent.

We will note in examining Section 11(b) that it is not ridiculous. Section 11(b) states, "The discharge of oil into or upon the navigable waters of the United States ... in harmful quantities ... is prohibited ..."

What then is the case relative to waste discharges into Galveston Bay? In May 1971, the Texas

Water Quality Board District Office examined for oil and grease the effluents from 18 petroleum industry plants who discharge an aggregate of 103 MGD of wastewater into the Houston Ship Channel. This examination revealed that of the 103 MGD, 51 MGD or 50 percent of the volume had oil and grease concentrations of 3.6 mg/l or less; 85 MGD or 83 percent of the volume had oil and grease concentrations of 30 mg/l or less; and 17 MGD or 17 percent of the volume had oil and grease concentrations in excess of 30 mg/l.

The significance of oil and grease concentrations of 3.6 mg/l and 30 mg/l is that they correspond according to my calculations, to the "best available treatment" and "base level treatment," respectively, in the proposed EPA petroleum refinery effluent standards.

The calculations were made using the 75 percent and 97 percent oil removal efficiencies shown for "base level treatment" and "best available treatment," respectively, and the amount of oil present in the effluent from the hypothetical typical oil refinery shown in the proposed EPA refinery effluent standards. Assuming that EPA adopts the standards as proposed, 83 percent of the effluents discharged to the Houston Ship Channel, according to our sample data, would meet the "base level treatment" requirements and 50 percent, the "best available treatment" requirements.

This is not to say that additional improvements should not be or will not be made. I have really only two points here. One is "any," the meaningless word -- it has to be tied down to a concentrating value.

The other point is a great deal more has been done relative to the removal of oil and grease from effluent discharge into the Houston Ship Channel than has been heretofore acknowledged.

Now, I would like to talk briefly about heavy metals. The Environmental Protection Agency report itself is the best source document to illustrate the effects of the alleged excessive quantities of heavy metals discharged into Galveston Bay.

By examining Table V-5, Page 41, of the

EPA report, it will be noted that there are no substantial differences between the concentrations of various heavy metals in the meats of oysters secured from Morgan Point, near the mouth of the Houston Ship Channel, and East Bay, an area which receives no industrial waste discharges of any kind. These things are side by side right there. I don't know that you can read it, but there are no differences. You can look at your black book. These two sample stations are as shown in here. That is Morgan Point and this is the Houston Ship Channel up here (indicating).

This is certainly not what you would expect since it would be supposed that a gradient would exist -- being high near the alleged source and progressively lower as one retreats from the source. This is what we found in the case of a mercury discharge in another estuary in the State.

Further, with respect to heavy metals, it would be in order to examine the metal concentrations in Galveston Bay oysters relative to the concentrations found in other estuaries in the United States. This is such an examination.

You will note that Galveston Bay oysters in general have lower concentrations of heavy metals than oysters from either the east or west coasts. This examination I think would certainly tend to calm any fears which might exist relative to the heavy metal situation which exists in Galveston Bay at this time.

By this I do not mean -- and I repeat -- I do not mean -- that the Texas Water Quality Board considers everything to be satisfactory. This is far from the case. In August 1970, the board passed board order No. 70-0828-5 which regulates the discharge of most hazardous metals. As fast as waste dischargers are found who are discharging wastewater contrary to this or other applicable board orders, corrections will be secured.

In this connection, Mr. Chairman, I would point out that we presently have 9 men stationed in our La Porte office. This is approximately 1/3 of our entire field staff for the whole State.

These men stationed at La Porte all -- I think without exception -- work more than a 40-hour week, even though they are on a straight salary. This extra time is freely given because of a sense of mission and because of believing in the work we are doing. It is a privilege for me to work with these men. The point I am trying to make here is that 9 men in our office can only do so much.

Now, I would like to talk about the results that we have effectuated. The Texas Water Quality Board, when it was established in 1967, had a very long way to go in attempting to correct long outstanding environmental abuses which had been accumulating for years due to municipal, industrial, and public indifference, and the ineffectiveness of local, State and Federal pollution abatement programs. And in saying this I do not mean that the folks who were involved in the program were not working hard. I am simply saying there were not enough resources to be brought to bear upon the problem. The story in Texas is no different from that in the Nation as a whole, except that we were and are somewhat better off because of a few farsighted individuals in State government. For example, Texas has had a policy for

D. Whittington

many years that all sewage should receive secondary treatment and chlorination. This policy was not always enforced, but its simple existence helped, and, as a consequence, Texas does not have raw sewage discharges as a matter of course.

Because we have had so far to go, and as the problem was of such magnitude, progress has been slow to manifest itself. It exists, nonetheless, and can easily be seen in these figures. These graphs represent the average conditions based on data tabulated by calendar year except for 1971. These are plots of the BOD versus time at three points on the Houston Ship Channel. This particular plot is at Morgan Point and you will note the decrease (indicating). The 1971 point is the average of the data collected through April 1971.

The dissolved oxygen concentration at Morgan Point appears to be responding to these decreased loads. There has been no significant response yet in the upper reaches of the channel and additional lowering of the BOD load will be required.

We do anticipate that continued improvements will occur, and that the bacteriological quality problem in Upper Galveston Bay west of the channel should dramatically improve in early 1972 when we get all of the sewage effluents properly chlorinated.

In summary it is our belief that: 1) we have demonstrated that water quality problems exist in the Galveston Bay estuary, 2) we have demonstrated that the Texas water quality requirements have idiosyncrasies and are not standards of such worth and scientific validity that they should be met regardless of the consequences, 3) we have demonstrated that Texas has an effective water quality program which is resulting in satisfactory -- although certainly not as rapid as we would like -- progress toward solutions to our problems, 4) we have demonstrated that the oil and grease situation, insofar as waste discharges go to Galveston Bay, are not as bad as pictured, 5) we have demonstrated that excessive heavy metals do not exist in Galveston Bay, and finally, 6) we have demonstrated that improvements, admittedly slow in becoming manifest to this point are, in fact, occuring.

These points which I have brought to your attention would appear to me to negate any necessity the conferees might feel to take, in the name of water quality, rash, unwise, or precipitous action which would severely harm the citizens of this area and the State of Texas. I would consequently urge the conferees to carefully review each proposed recommendation in this light.

Could we have the lights?

Mr. Chairman, that concludes my presentation.

(Applause.)

MR. WHITTINGTON: Mr. Chairman, the papers which I had handed out to you -- the text I have read and the paper handed you are not identical inasmuch as I did not have the method to reproduce the pictures and the conversation would have been meaningless without this.

CHAIRMAN STEIN: We discussed this while you were making your presentation and I talked to Mr. Yantis about that.

If you would give us prints of those

pictures, which I understand you can, we will make them exhibits and part of the record.

[The above-mentioned prints are marked exhibits and are on file at HQ, EPA, Washington, D. C. and Region VI, Dallas, Texas.]

[The formal report follows.]

WATER QUALITY REPORT
GALVESTON BAY COMPLEX
STATE OF TEXAS

prepared for

EPA - WQO ENFORCEMENT CONFERENCE
Houston, Texas
June 7, 8, & 9, 1971

by

TEXAS WATER QUALITY BOARD
FIELD OPERATIONS DIVISION

TABLE OF CONTENTS

Title

Page

List of Figures ii

List of Tables iii

Problem 1

- Zones out of Compliance 1
- Idiosyncrasies of Water Quality Requirements 1
- Attitude of Texas Water Quality Board 6

Corrective Program

- Houston Ship Channel and San Jacinto River Tidal 7
- Upper Galveston Bay West of the Ship Channel 10
- Trinity Bay, Zone 1103 14
- Clear Lake, Zone 0903 16
- General 16
  - Oil and Grease 16
  - Heavy Metals 18

Results 24

Summary 28

LIST OF FIGURES

Number	Title	Page
1	Map of Water Quality Zones in Galveston Bay Complex	2
2	Idiosyncrasies of Water Quality Requirement	4
3	Decrease in B.O.D. Load Discharged to the Houston Ship Channel	8
4	Percent Fecal vs. Total MPN, Trinity Bay Data	15
5	Portion of Section (11) (b) (2) of the Federal Water Quality Act as Amended	17
6	Portion of Proposed EPA Oil Refinery Effluent Standards	19
7	EPA Sample Stations	21
8	B.O.D. vs. Time, Turning Basin, Houston Ship Channel	25
9	B.O.D. vs. Time, San Jacinto Monument, Houston Ship Channel	26
10	B.O.D. vs. Time, Morgan Point, Houston Ship Channel	27

LIST OF TABLES

Number	Title	Page
1	Water Quality Zone out of Compliance with Water Quality Requirements . . .	3
2	Idiosyncrasies of Water Quality Requirements, Gulf at Galveston, Zone 0901	5
3	Houston Ship Channel Pollutant Loading	9
4	Chlorination Practices, Houston Ship Channel including Baytown	11
5	Chlorination Practices, Clear Lake Watershed	13
6	EPA Report Table V-5, Metal Concentration in Oysters from Galveston Bay	20
7	Range of Trace Metal Values in Shellfish	22

Zones out of Compliance:

The Galveston Bay complex includes fourteen water quality zones (as shown in Figure 1) for which WATER QUALITY REQUIREMENTS, commonly called stream standards, have been adopted by the State and accepted by the Federal government. Some of these zones were out of compliance when the Texas Water Quality Board was established, and they have not yet been brought into compliance.

These zones (as shown in Table 1) are: (1) the Houston Ship Channel zones (0904, 0905, 0906) and the San Jacinto River Tidal zone (0903) which are out of compliance with the oxygen resources parameters, (2) the Clear Lake zone (0907) which is also out of compliance with oxygen resources parameters, although less severely and frequently than the Houston Ship Channel, (3) Upper Galveston Bay West of the Ship Channel (1104) is over a portion of its area noncompliant with respect to dissolved oxygen and bacteriological quality, and (4) portions of Trinity Bay (1103) are noncompliant relative to bacteriological quality.

Idiosyncrasies of Water Quality Requirements:

The fact that these zones are noncompliant with the WATER QUALITY REQUIREMENTS does not necessarily mean that a real problem exists. Those of you who have read the EPA report will recall that the incongruity of having a lower B.O.D. criterion for Zone 0906 of the Houston Ship Channel than for Galveston Bay, Zone 1104, was pointed out. Further problems of this nature can easily be noted. Zone 0906 of the Houston Ship Channel has a lower MPN than Galveston Bay, Zone 1104. These problems are illustrated in Figure 2. The dissolved oxygen concentration established for the Gulf of Mexico at Galveston is 115% of saturation at the salinity and temperature which sometimes exists - a standard physically impossible to meet. The B.O.D. criterion for the Gulf at Galveston is 1 mg/l, well below normal gulf water. These problems, shown in Table 2, point out the basic lack of scientific validity in all instances of the WATER QUALITY REQUIREMENTS. In pointing out this lack, I do not intend to criticize either the State who prepared the REQUIREMENTS, nor the Federal government who accepted them. It must be remembered that the REQUIREMENTS were prepared by the State at the insistence of the Federal government in a very short time by a very few persons. The REQUIREMENTS were undoubtedly accepted by the Federal government under the same handicap. The point here is that the REQUIREMENTS should be viewed as what they are, i.e., a generally sound guideline for water quality management. They should not be viewed as sacred, rigid, unchangeable REQUIREMENTS possessing great scientific validity and social worth.

FIGURE 1

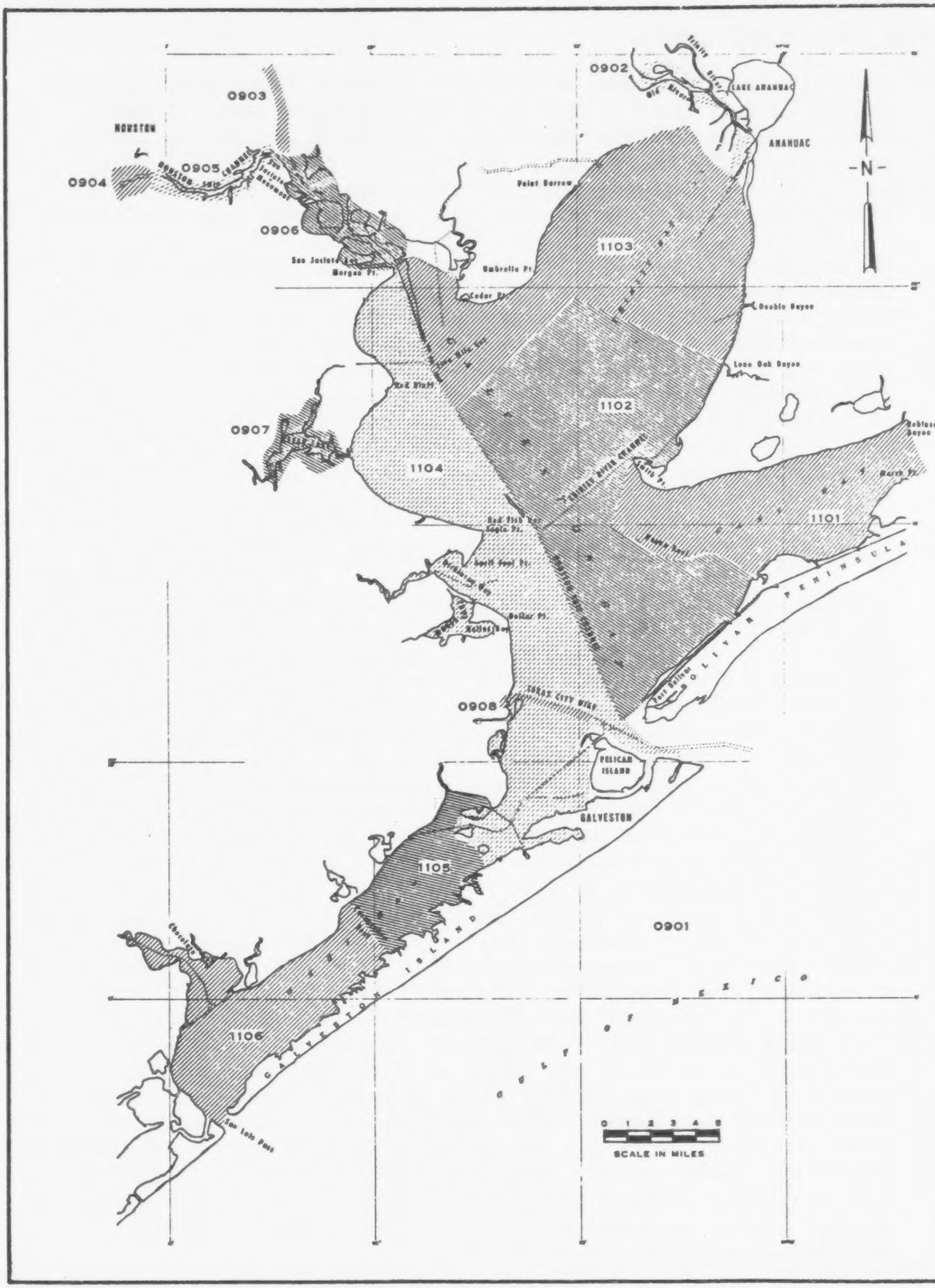

0903
HOUSTON
0904
0905
HOUSTON SHIP CHANNEL
0906
San Jacinto Bay
Morgan Pt.
0902
LAKE ANAHUAC
Old River
ANAHUAC
-N-
Point Barrow
Umbrella Pt.
Cedar Pt.
1103
TRINITY BAY
Double Bayou
Red Bluff
Lone Oak Bayou
1102
0907
1104
TRINITY RIVER CHANNEL
Robinson Bayou
Marsh Pt.
1101
Red Fish Bar
Eagle Pt.
Dollar Pt.
HOUSTON SHIP CHANNEL
BOLIVAR PENINSULA
Port Bolivar
0908
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
1105
0901
GALVESTON ISLAND
GULF OF MEXICO
1106
San Luis Pass
0 1 2 3 4 5
SCALE IN MILES

TABLE 1

THE PROBLEM

Zone	Parameter Out of Compliance
0904 - Houston Ship Channel	Dissolved Oxygen, BOD
0905 - Houston Ship Channel	Dissolved Oxygen, BOD
0906 - Houston Ship Channel	Dissolved Oxygen, BOD
0903 - San Jacinto Tidal	Dissolved Osygen, BOD
0907 - Clear Lake	BOD
1104 - Galveston Bay West of Channel	Dissolved Oxygen*, BOD*, and MPN*
1103 - Trinity Bay	MPN*

*in Limited Areas only

FIGURE 2

IDIOSYNCRASIES OF WATER QUALITY REQUIREMENTS IN GALVESTON BAY AREA

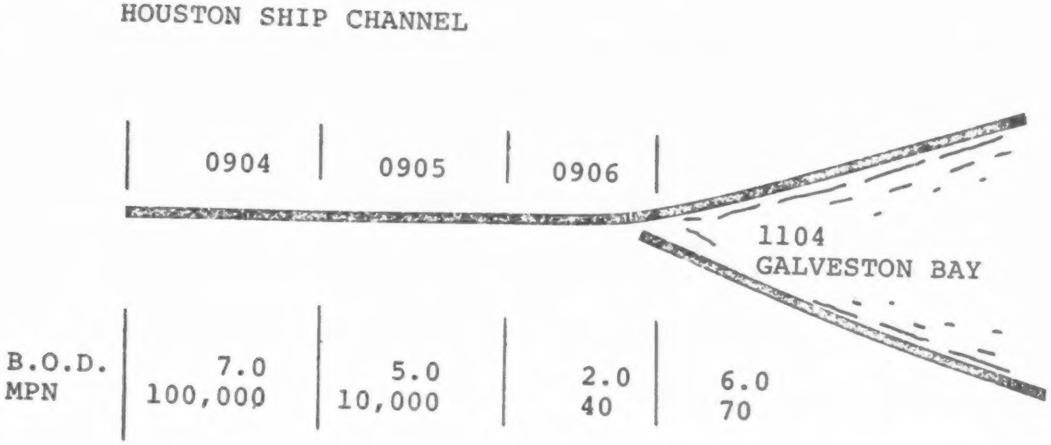

HOUSTON SHIP CHANNEL
0904
0905
0906
1104
GALVESTON BAY
B.O.D.
MPN
7.0
100,000
5.0
10,000
2.0
40
6.0
70

TABLE 2

IDIOSYNCRASIES OF WATER QUALITY REQUIREMENTS
GULF OF MEXICO AT GALVESTON
ZONE 0901

	CHLORIDES mg/l	TEMPERATURE	DISSOLVED OXYGEN mg/l
Standard	20,000	30°C[1]	7.0
Possible Dissolved Oxygen Concentration at Temperature and Chlorides Shown			6.1
Percent Saturation			115%

[1] Temperature Routinely Measured in Gulf Water at Texas Water Quality Board Sample Stations

Average of all Gulf of Mexico Samples examined for B.O.D. including those from Sabine Pass, Bolivar Roads, Port Aransas, and Port Manisfield........................ 2.1 mg/l

Standard for Zone 0901.............................. 1 mg/l

Attitude of Texas Water Quality Board:

Nevertheless, it is the view of the Texas Water Quality Board that the zones pointed out previously in this paper as being out of compliance with the requirements are real problems and not idiosyncrasies of the requirements. These problems were existent when the Texas Water Quality Board was created in 1967--they are not new. Regardless, the Board has not and is not satisfied with the status quo. We feel and have felt since the agency was formed that the situation is intolerable and that the real problems must be corrected. Toward this end, a corrective program was formulated and placed into motion. I would like to briefly discuss this corrective program.

CORRECTIVE PROGRAM

Houston Ship Channel and San Jacinto River Tidal:

The problem in the Houston Ship Channel (Zones 0904, 0905, and 0906) is caused by large volumes of both municipal and industrial waste being discharged into a deep, relatively narrow, artificial channel which receives very little fresh water inflow and very limited tidal flushing--both the hydrology and geometry of the channel mitigating against its ability to assimilate wastewater. The problem in the tidal reach of the San Jacinto (Zone 0903) is related inasmuch as this problem is primarily due to the diffusion of pollutants up the river because of the very limited, practically nonexistent, fresh water inflow. It was, and is, obvious that the first step toward a solution to the water quality problem in these zones is to lower the waste load--although additional and/or different approaches may be required before a truly satisfactory solution has been found.

With respect to lowering the load, Figure 3 shows the decrease in the measured B.O.D. load being discharged into the Houston Ship Channel since 1968. The data shown for 1968, 1969, and the first portion of 1970, are the B.O.D. loads as determined by our district office from single measurements at each source. The data for the latter portion of 1970 and 1971 were calculated by months, using a digital computer and the self-report data supplied by each waste discharger pursuant to Board Order #69-1219-1. This Board Order adopted by the Board on April 24, 1970, requires each waste discharger holding a waste control order from the Board to report monthly on the volume and quality of wastewater discharged during the month. In the case of larger discharges, continuous flow measurements and analyses on composite samples are required. As a consequence, these data are considerably more accurate than the earlier single measurement data as secured by our district office. The last calculation shown on Figure 3 is the load existent as of April, 1971.

Also shown is a 1970 estimate of the total raw B.O.D. load prior to treatment. It should be remembered in viewing this graph that the raw waste load prior to treatment has and will continue to increase with time due to the population and industrial growth of Houston. The decrease has been effectuated in spite of the growth in the raw waste load.

Additionally, the treated B.O.D. load, authorized by waste control orders issued by the Texas Water Quality Board as of April, 1971, is shown.

HOUSTON SHIP CHANNEL
B.O.D. LOADING

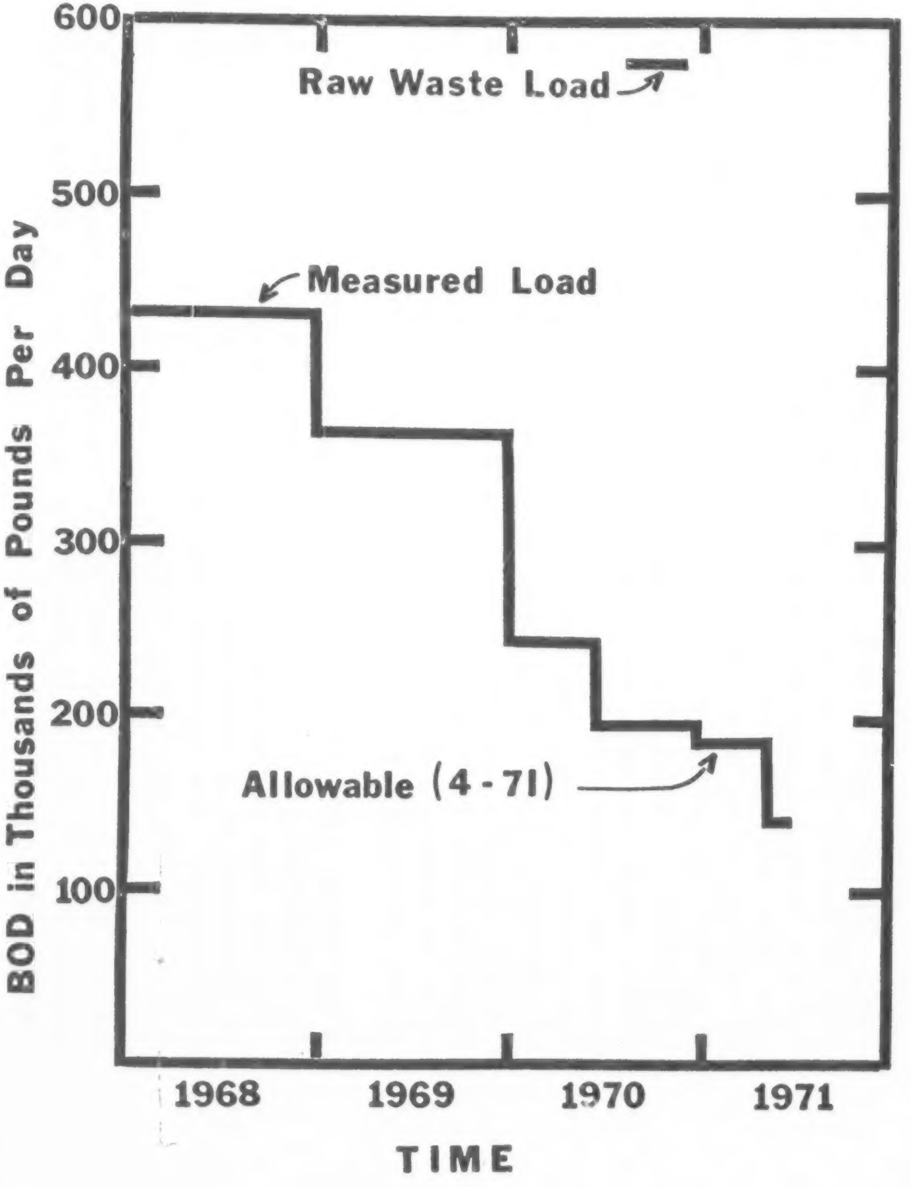


TABLE 3

HOUSTON SHIP CHANNEL POLLUTANT LOADING
(Includes Baytown Area)

POLLUTANT

	C.O.D. lbs/day	T.S.S. lbs/day	Oil & Grease lbs/day
Authorized	781,000	328,000	43,700
May, 1971	513,000	284,000	28,800*
Percent of Authorized	66%	86%	66%

*Extrapolated from Measured Data

8 OF 9

PB

229582

1.0
4.5
5.0
5.6
6.3
7.1
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

You will note from Figure 3 that: (1) a considerable decrease has been effectuated, (2) the aggregate B.O.D. load discharged to the Channel is less than that authorized, and (3) an overall B.O.D. removal of about 76% is being realized.

This progress was not achieved miraculously--it was achieved by both municipalities' and industries' spending large sums for treatment works.

Additional progress will be made. The City of Houston at the moment, as well as several industries, have additional treatment facilities under construction which will further lower the load. The 20 mgd expansion of the City of Houston's Northside sewage treatment plant should be placed on stream very shortly. This facility will result in a sizeable reduction in the load being discharged.

I think you must agree from these data that the Texas program is effectuating a rapid--I would say spectacular--decrease in the B.O.D. load being discharged. This has been accomplished with a minimum of cost to the citizens of the State of Texas,and very little unnecessary interference with our local governments and industries. Such a program is possible only where reason prevails.

Similarly, other pollutants such as C.O.D. and Total Suspended Solids have been lowered although we have not documented their decrease as we have in the instance of B.O.D. The situation which existed as of April, 1971, is as shown on Table 3. You will note in each case that the actual discharge is less than that authorized by waste control order.

Upper Galveston Bay West of the Ship Channel:

The problems in Upper Galveston Bay west of the Ship Channel are low dissolved oxygen values and high B.O.D. values in spots, primarily near Morgan Point. Also, higher than acceptable bacteriological densities exist at times.

The B.O.D. and dissolved oxygen problems will be corrected when the Houston Ship Channel problem is solved.

The bacteriological problem in Upper Galveston Bay west of the Ship Channel is due to bacteria derived from three sources: (1) treated but not properly disinfected domestic sewage, (2) land wash, i.e., rainfall runoff from contaminated areas, and (3) waste discharges from ships and other vessels. The percentage of the problem attributable to each of these sources is not known but it is quite likely that the first two sources, treated sewage discharge and land wash, are the more important.

TABLE 4

CHLORINATION PRACTICES

Houston Ship Channel Including Baytown

STATUS	NO.[1]	%	VOLUME, mgd[1]	%
Properly Chlorinating	74	59	45	24
Chlorinating, Not Totally Satisfactory	32	26	40	21
Not Chlorinating	2	2	103	54
No Data for Month	16	13	2	1
Total	124	100	190	100

[1] Based on February, 1971, Self Report

Progress is being made in bringing about proper disinfection of the treated domestic sewage discharges in the Galveston Bay area. During February, 1971, the chlorination practices at the sewage treatment plant located on the Houston Ship Channel were as shown in Table 4. You will note at that time, of the 190 mgd of treated sewage being discharged, 24% of the volume was properly chlorinated; 21% of the volume was chlorinated but not totally satisfactorily--by this, I mean that at least once during the month the chlorine residual was not adequate; 54% of the volume was not chlorinated; and we have no data for 1% of the volume. I am happy to report that the City of Houston's chlorination facilities at their Northside sewage treatment plant will go "on stream" very shortly. With the advent of chlorination at this plant, the plants where chlorination is practiced increased to 74%, with 72% of the effluent discharged chlorinated.

Further improvements are forthcoming. The City of Houston is proposing to let bids in the immediate future for chlorination facilities at its Sims Bayou Plant. It is anticipated these facilities will be "on stream" by early 1972. When this is accomplished, all of the sewage treatment facilities located on the Houston Ship Channel of which the Texas Water Quality Board has knowledge will have the required facilities for proper disinfection. The securement of proper chlorination then resolves itself to one of providing adequate surveillance and enforcement to insure that the facilities provided are used. This, the Board intends to do.

In the Clear Lake watershed, approximately 85% of the plants are properly chlorinating as revealed by duplicate inspections conducted during February, March, and April, 1971. All plants are equipped with the required facilities. The additional inspection frequency which we plan on inaugurating when our staff is expanded at the beginning of our upcoming fiscal year should increase the 85% proper operations.

In the past, problems have been noted in the bay adjacent to the City of Galveston's main sewage treatment plant. This problem is illustrated in Figure V-3 of the EPA report. Figure V-3 is based on data secured during the periods December, 1968, through April, 1969, and December, 1969, through April, 1970. Since these data were collected, a considerable improvement in the situation at Galveston has been effectuated. We would hasten to add at this point that the problem has been improved--not yet totally corrected. The City, during recent months, has, however, been able to provide proper chlorination for its waste discharge.

TABLE 5

CHLORINATION PRACTICES

Clear Lake Watershed

STATUS	Feb.-Mar., 1971 No.	Feb.-Mar., 1971 %	April, 1971 No.	April, 1971 %
Properly Chlorinating	26	90	23	80
Chlorinating, Not Totally Satisfactory	2	7	5	17
Not Chlorinating	0	0	0	0
No Data Secured	1	3	1	3
Total	29	100	29	100

Insofar as the water quality problems in Upper Galveston Bay west of the Ship Channel are concerned, I would repeat that the dissolved oxygen related problems will be solved when the load on the Houston Ship Channel is adequately lower. Further, with the advent of the City of Houston placing the chlorination facilities at the Sims Bayou treatment plant into operation, an event scheduled for early 1972, it is our view that a major improvement in the average bacteriological quality situation in the Bay will materialize. We do not know if this improvement will be sufficient to avoid high coliform densities in portions of this zone of the Bay during periods of significant rainfall runoff where land wash is a major influence.

Trinity Bay, Zone 1103:

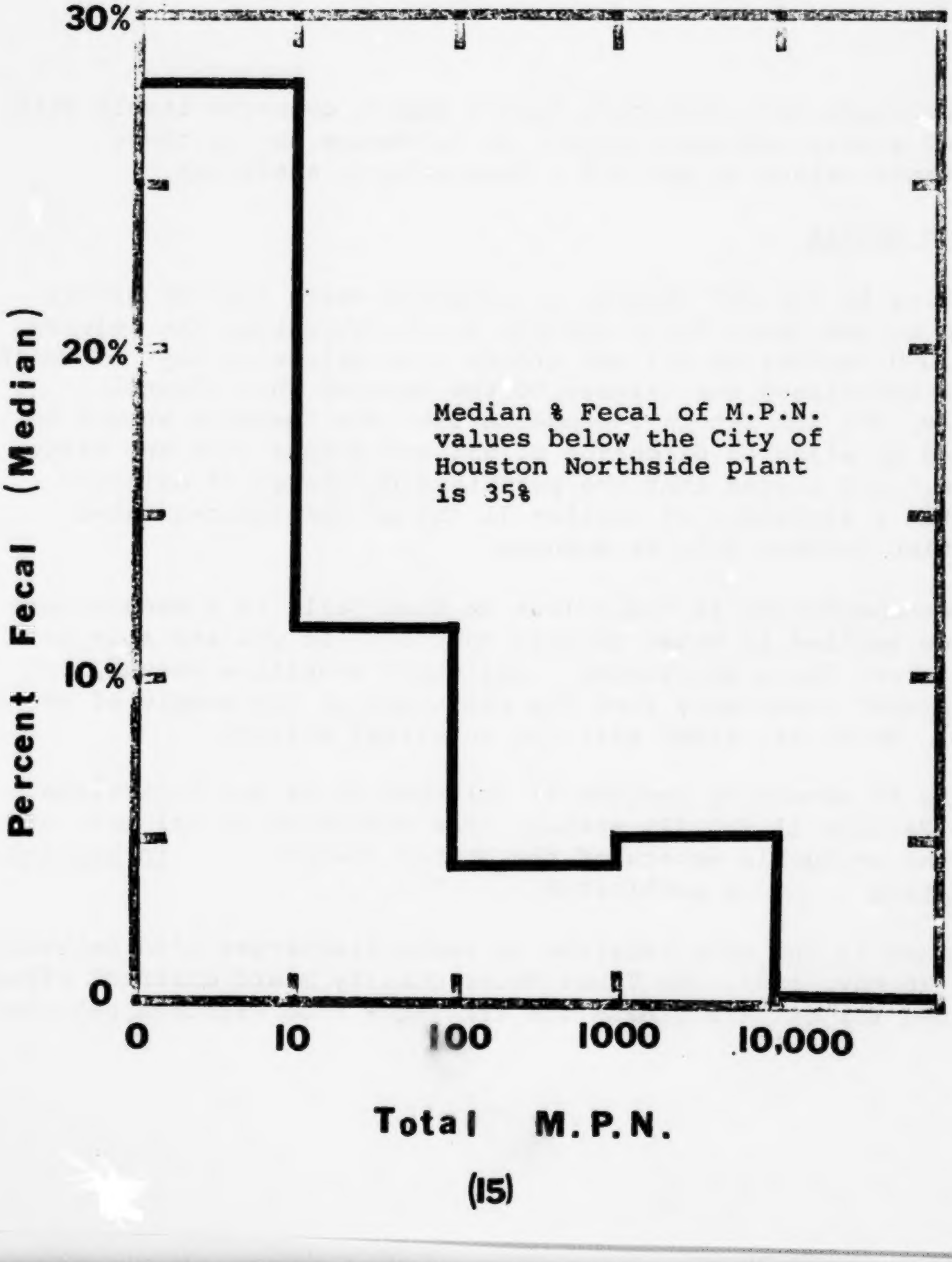
Trinity Bay, prior to the advent of the Houston Light and Power Company's Cedar Bayou generation station, received no large wastewater discharges of any kind. Nevertheless, portions of Trinity Bay have for many years been noncompliant with the bacteriological requirements. This is difficult to understand inasmuch as the Bay receives no direct point waste discharges of any magnitude. In fact, the periphery of the Bay is almost totally undeveloped, having only four small communities on its banks--Anahuac with a population of 1986, Beach City with a population of 200, and Smith Point and Oak Islands with populations too small to be included in the Texas Almanac. All of these communities utilize septic tanks at the moment for sewage disposal.

It is our judgment that the problem here is related to land wash and wastes from diffuse sources--certainly not point waste discharges. An examination of the percentage of fecal coliform organisms at various MPN values is indicative of this fact. You will note that the higher the MPN, the lower the percent fecal organisms. This indicates that these organisms are largely derived from land wash. The solution to the bacteriological quality problem in the portions of Trinity Bay affected is unclear.

The experience in Trinity Bay would tend to question the view that the problem in Upper Galveston Bay west of the Channel is totally related to point discharges of treated sewage.

PERCENT FECAL vs TOTAL M.P.N.

Data collected at Stations 23, 24, 25, 26, 27, & 28 in
Trinity Bay from July, 68 through October, 69



Median % Fecal of M.P.N. values below the City of Houston Northside plant is 35%

Clear Lake, Zone 0907:

The problem in Clear Lake is one of eutrophication. In order to cope with this problem, the Board adopted on August 28, 1970 Board Order #69-9A requiring tertiary treatment by August 28, 1972.

It is our belief that the increased treatment level required by this Board Order, plus heightened surveillance and enforcement of the law as it relates to waste spills on the watershed, will bring the zone into compliance. Increased surveillance and enforcement will be possible during our next budget year since we will more than double the size of our district office staff.

General:

The Environmental Protection Agency report concerns itself with oil and grease and heavy metals in Galveston Bay as these pollutants relate to seafood - particularly shellfish.

Oil and Grease

According to the EPA report, outstanding waste control orders issued by the Texas Water Quality Board authorizes the release of 55,000 lbs/day of oil and grease into Galveston Bay, of which 98% is authorized for release to the Houston Ship Channel. Further, the EPA report recommends that the "permits should be amended to allow no discharge of oil and grease from any waste source," and states that the permitted discharge of oil constitutes a violation of Section 11 (b) of the Federal Water Pollution Control Act, as amended.

The recommendation is ridiculous in that "all" is a meaningless term as applied to water quality control. If you are able to make a test for a particular pollutant sensitive enough, you will almost invariably find the pollutant in any sample of wastewater. Water is, after all, the universal solvent.

We note in examining Section 11 (b) that it is not ridiculous since Section 11 (b) (2) states, "The discharge of oil into or upon the navigable waters of the United States . . . in harmful quantities . . . is prohibited. . . "

What then is the case relative to waste discharges into Galveston Bay? In May, 1971, the Texas Water Quality Board district office examined for oil and grease the effluents from eighteen petroleum (k)[43](1) At the request of a majority of the conferees in any conference called under this section the Secretary is authorized to request any person whose alleged activities result in discharges causing or contributing to water pollution, to file with him a report (in such form as may be prescribed in regulations promulgated by him) based on existing data, furnishing such information as may reasonably be requested as to the character, kind, and quantity of such discharges and the use of facilities or other means to prevent or reduce such discharges by the person filing such a report. No person shall be required in such report to divulge trade secrets or secret processes, and all information reported shall be considered confidential for the purposes of section 1905 of title 18 of the United States Code.

(2) If any person required to file any report under this subsection shall fail to do so within the time fixed by regulations for filing the same, and such failure shall continue for thirty days after notice of such default, such person may, by order of a majority of the conferees, be subject to a forfeiture of $100 for each and every day of the continuance of such failure which forfeiture shall be payable into the Treasury of the United States and shall be recoverable in a civil suit in the name of the United States brought in the district where such person has his principal office or in any district in which he does business. The Secretary may upon application therefor remit or mitigate any forfeiture provided for under this subsection and he shall have authority to determine the facts upon all such applications.

(3) It shall be the duty of the various United States attorneys, under the direction of the Attorney General of the United States, to prosecute for the recovery of such forfeitures.

CONTROL OF POLLUTION BY OIL [44]

SEC. 11. (a) For the purpose of this section, the term—

(1) "oil" means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil;

(2) "discharge" includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping;

(3) "vessel" means every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel;

(4) "public vessel" means a vessel owned or bare-boat chartered and operated by the United States, or by a State or political subdivision thereof, or by a foreign nation, except when such vessel is engaged in commerce;

(5) "United States" means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands;

(6) "owner or operator" means (A) in the case of a vessel, any person owning, operating, or chartering by demise, such vessel, and (B) in the case of an onshore facility, and an offshore facility, any person owning or operating such onshore facility or offshore facility, and (C) in the case of any abandoned offshore facility, the person who owned or operated such facility immediately prior to such abandonment;

(7) "person" includes an individual, firm, corporation, association, and a partnership;

(8) "remove" or "removal" refers to removal of the oil from the water and shorelines or the taking of such other actions as may be necessary to minimize or mitigate damage to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches;

(9) "contiguous zone" means the entire zone established or to be established by the United States under article 24 of the Convention on the Territorial Sea and the Contiguous Zone;

(10) "onshore facility" means any facility (including, but not limited to, motor vehicles and rolling stock) of any kind located in, on, or under, any land within the United States other than submerged land;

(11) "offshore facility" means any facility of any kind located in, on, or under, any of the navigable waters of the United States other than a vessel or a public vessel;

(12) "act of God" means an act occasioned by an unanticipated grave natural disaster;

(13) "barrel" means 42 United States gallons at 60 degrees Fahrenheit.

(b)(1) The Congress hereby declares that it is the policy of the United States that there should be no discharges of oil into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone.

(2) The discharge of oil into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone in harmful quantities as determined by the President under paragraph (3) of this subsection, is prohibited, except (A) in the case of such discharges into the waters of the contiguous zone, where permitted under article IV of the International Convention for the Prevention of Pollution of the Sea by Oil, 1954, as amended, and (B) where permitted in quantities and at times and locations or under such circumstances or conditions as the President may, by regulation, determine not to be harmful. Any regulations issued under this subsection shall be consistent with maritime safety and with marine and navigation laws and regulations and applicable water quality standards.

(3) The President shall by regulation, to be issued as soon as possible after the date of enactment of this paragraph, determine for the purposes of this section, those quantities of oil the discharge of which, at such times, locations, circumstances, and conditions, will be harmful to the public health or welfare of the United States, including, but not limited to, fish, shellfish, wildlife, and public and private property, shorelines, and beaches except that in the case of the discharge of oil into or upon the waters of the contiguous zone, only those discharges which threaten the fishery resources of the contiguous zone or threaten

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[43] This subsection added by sec. 208(a), Public Law 89–753.
[44] Added by sec. 102, Public Law 91–224.

industry plants who discharge an aggregate of 103 mgd of wastewater into the Houston Ship Channel. This examination revealed that of the 103 mgd, 51 mgd or 50% of the volume had oil and grease concentrations of 3.6 mg/l or less; 85 mgd or 83% of the volume had oil and grease concentrations of 30 mg/l or less; and 17 mgd or 17% of the volume had oil and grease concentrations in excess of 30 mg/l. The significance of oil and grease concentrations of 3.6 mg/l and 30 mg/l is that they correspond according to my calculations to the "best available treatment" and "base level treatment," respectively, in the proposed EPA petroleum refinery effluent standards. The calculations were made using the 75% and 97% oil removal efficiencies shown for "base level treatment" and "best available treatment," respectively, and the amount of oil present in the hypothetical typical oil refinery shown in the proposed EPA refinery effluent standards. Assuming that EPA adopts the standards as proposed, 83% of the effluent discharged to the Houston Ship Channel, according to our sample data, would meet the "base level treatment" requirements and 50%, the "best available treatment" requirements.

This is not to say that additional improvements should not be or will not be made. The point I am making is that a great deal has been done relative to the removal of oil from petroleum industry waste discharges into Galveston Bay.

Heavy Metals

The Environmental Protection Agency report itself is the best source document to illustrate the effects of the alleged excessive quantities of heavy metals discharged into Galveston Bay.

By examining Table V-5, page 41, of the EPA report (Table 6), it will be noted that there are no substantial differences between the concentrations of various heavy metals in the meats of oysters secured from Morgan Point, near the mouth of the Houston Ship Channel, and East Bay, an area which receives no industrial waste discharges of any kind. These two sample stations are as shown in Figure 7. This is certainly not what you would expect since it would be supposed that a gradient would exist--being high near the alleged source and progressively lower as one retreats from the source. This is what was found in the case of a mercury discharge in another estuary on the Texas Coast.

Further, it would be in order to examine the metal concentrations in Galveston Bay oysters relative to the concentrations found in other estuaries in the United States. Table 7 is such an examination.

TABLE 6

MORGAN POINT

EAST BAY

TABLE V-5

METALS CONCENTRATIONS IN OYSTERS FROM GALVESTON BAY[1/]
NOVEMBER 12, 1970
(MICROGRAMS PER GRAM - WET WEIGHT)

Parameter	Station No. 1	Station No. 2	Station No. 3	Station No. 4a	Station No. 5	Station No. 6	Station No. 7
Zinc	> 35.30	> 39.70	20.46	26.12	21.58	20.26	22.87
Copper	8.24	9.52	5.06	4.79	4.13	7.80	5.23
Cadmium	.41	< .15	< .15	< .15	< .15	< .15	< .15
Lead	< .30	< .30	< .30	< .30	< .30	< .30	< .30
Chromium	< .07	< .07	< .26	< .07	.27	.42	.16
Mercury	.008	.062	.028	.040	.030	.045	.007
Arsenic	< .30	< .30	< .30	< .30	.47	< .30	< .30
Boron	.87	1.65	.66	.58	.78	.38	.76
Phosphorus	270	258	102	225	185	102	196
Iron	14.71	12.30	4.63	7.34	5.55	5.93	13.10
Molybdenum	.47	1.32	1.51	1.57	1.01	.99	.29
Manganese	1.18	.67	.36	.70	.47	.50	.83
Aluminum	21.77	17.84	8.51	13.50	12.33	16.51	25.10
Beryllium	< .0015	< .0015	< .0015	< .0015	< .0015	< .0015	< .0015
Silver	.25	< .015	< .015	< .015	< .015	< .015	.11
Nickel	.24	.75	< .15	.37	< .15	< .15	.25
Cobalt	< .15	< .15	< .15	< .15	< .15	< .15	< .15
Vanadium	< .30	< .30	< .30	< .30	< .30	< .30	< .30
Barium	.20	.03	.04	.15	.07	.06	.15
Strontium	1.53	1.65	1.72	1.80	5.92	3.45	2.40

[1/] See Figure V-11 for sampling locations.

FIGURE 6

Table C-2

Selected BLT and BAT for Petroleum Refining Industry

Contaminants	Removal Efficiencies, Percent	
	BLT	BAT
BOD	84	94
COD	65	84
Oil	75	97
Suspended Solids	60	88
Phenol	97	99.9
Sulfide	99	100
Ammonia	---	95

The Base Level of Treatment (BLT) is intended to be applied to all refineries regardless of location, point of discharge, or receiving watercourse conditions. Any level of treatment higher than BLT but up to the level of best available treatment (BAT) may also be applied to a specific refinery when the local water quality standards of a receiving stream call for higher treatment.

FIGURE 7

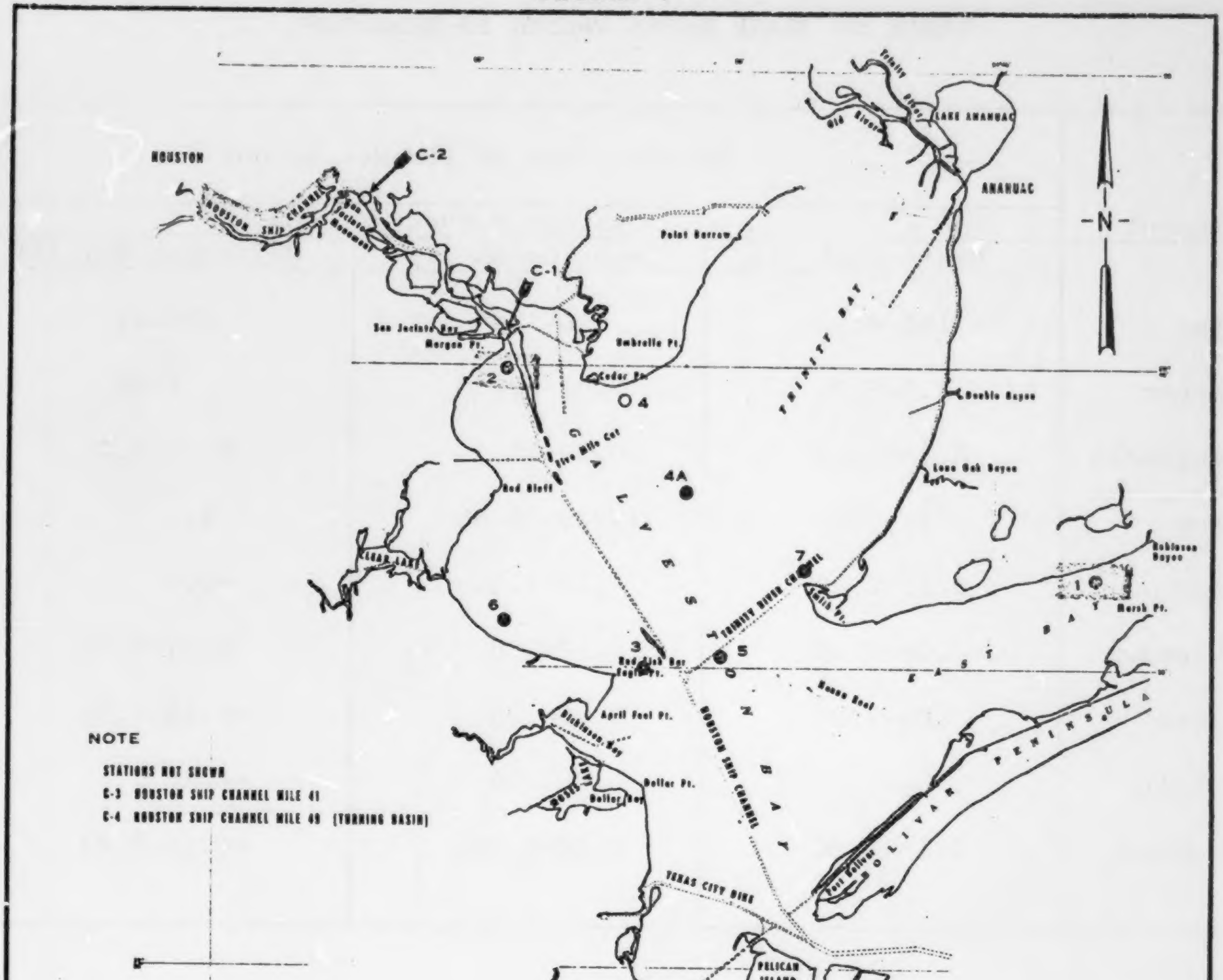

HOUSTON
C-2
HOUSTON SHIP CHANNEL
C-1
Point Barrow
San Jacinto Bay
Morgan Pt.
Umbrella Pt.
Cedar Pt.
2
O4
Five Mile Cut
Red Bluff
4A
Clear Lake
6
3
Red Fish Bar
Eagle Pt.
5
7
TRINITY RIVER CHANNEL
Smith Pt.
TRINITY BAY
GALVESTON BAY
EAST BAY
Hanna Reef
April Fool Pt.
Dickinson Bay
Dollar Pt.
Dollar Bay
HOUSTON SHIP CHANNEL
TEXAS CITY DIKE
PELICAN ISLAND
GALVESTON
Trinity River
Old River
LAKE ANAHUAC
ANAHUAC
Double Bayou
Lone Oak Bayou
Robinson Bayou
Marsh Pt.
1
BOLIVAR PENINSULA
Port Bolivar
WEST BAY
Carancahua Reef
Chocolate Bay
GALVESTON ISLAND
San Luis Pass
GULF OF MEXICO
N
NOTE
STATIONS NOT SHOWN
C-3 HOUSTON SHIP CHANNEL MILE 41
C-4 HOUSTON SHIP CHANNEL MILE 49 (TURNING BASIN)
LEGEND
● OYSTER AND WATER SAMPLING STATION
○ WATER SAMPLING STATION
0 1 2 3 4 5
SCALE IN MILES

Figure V - 11 Water and Oyster Sampling Locations - FWQA Reconnaissance Survey, November 1970

TABLE 7

RANGE OF TRACE METAL VALUES IN SHELLFISH

Element	Values given in PPM Wet Weight		
	Oysters Harvested From		
	East Coast (1)	West Coast (1)	Galveston Bay (2)
Zinc	180-4120	86-344	>35-21
Copper	7.0-517	7.80-37.50	4-10
Manganese	0.14-15.0	0.90-16	0.36-1.2
Iron	31-238	15.30-91.40	4.6-15
Lead	0.10-2.30	.10-4.50	<0.3
Chromium	.04-3.40	0.10-.30	<0.07-0.26
Nickel	.08-1.80	0.10-.20	<0.15-0.75
Cobalt	.06-.20	0.10-.20	<0.15
Cadmium	0.10-7.80	0.20-2.10	<0.15-0.41

(1) Pringle, B. H., Trace Metal Accumulation by Estuarine Mollusks, U. S. Department of Health, Education, and Welfare, Public Health Service, National Symposium on Estuarine Pollution, Stanford University, August, 1967.

(2) Division of Field Investigations - Denver Center and South Central Region, Report on Pollution Affecting Shellfish Harvesting in Galveston Bay, Texas, Environmental Protection Agency, Water Quality Office, March, 1971.

You will note that Galveston Bay oysters, in general, have lower concentrations of heavy metals than oysters from either the East or West Coasts. This examination would certainly tend to calm any fears which might exist relative to the heavy metal situation which exists in Galveston Bay at this time.

By this, I do not mean that the Texas Water Quality Board considers everything to be satisfactory. This is far from the case. In August, 1970, the Board passed Board Order No. 70-0828-5 which regulates the discharge of most hazardous metals. As fast as waste dischargers are found who are discharging wastewater contrary to this or other applicable Board order, corrections will be secured.

RESULTS

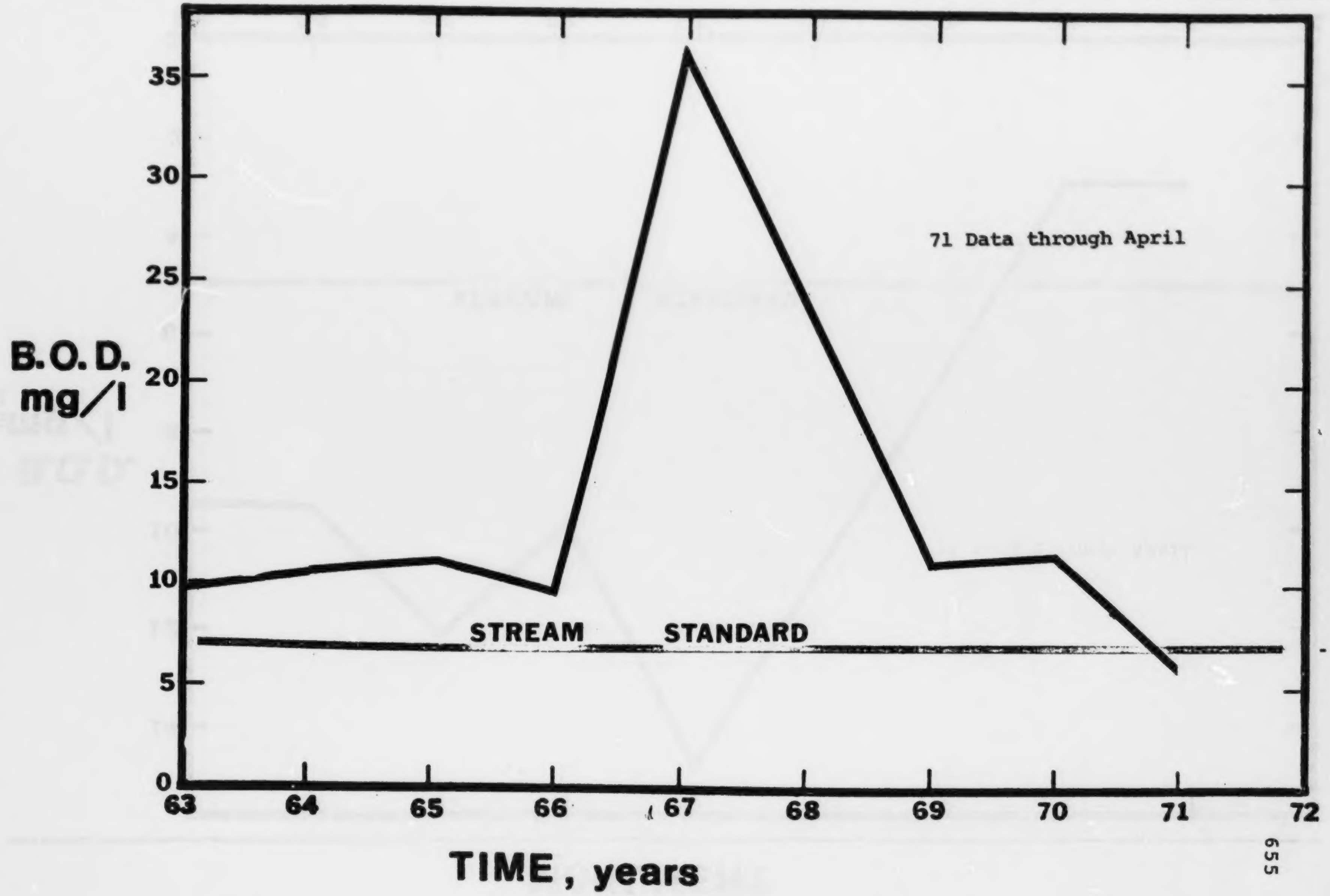
The Texas Water Quality Board, when it was established in 1967, had a very long way to go in attempting to correct long outstanding environmental abuses which had been accumulating for years due to municipal, industrial, and public indifference, and the ineffectiveness of local, state and federal pollution abatement programs. The story in Texas is no different from that in the nation as a whole, except that we were and are somewhat better off because of a few farsighted individuals in state government. For example, Texas has had a policy for many years that all sewage should receive secondary treatment and chlorination. This policy was not always enforced, but its simple existence helped and, as a consequence, Texas does not have raw sewage discharges as a matter of course.

Because we have had so far to go and as the problem was of such magnitude, progress has been slow to manifest itself. It exists, nonetheless, and can easily be seen in Figures 8, 9, and 10. These graphs represent the average condition based on data tabulated by calendar year except for 1971. The 1971 point is the average of the data collected through April, 1971.

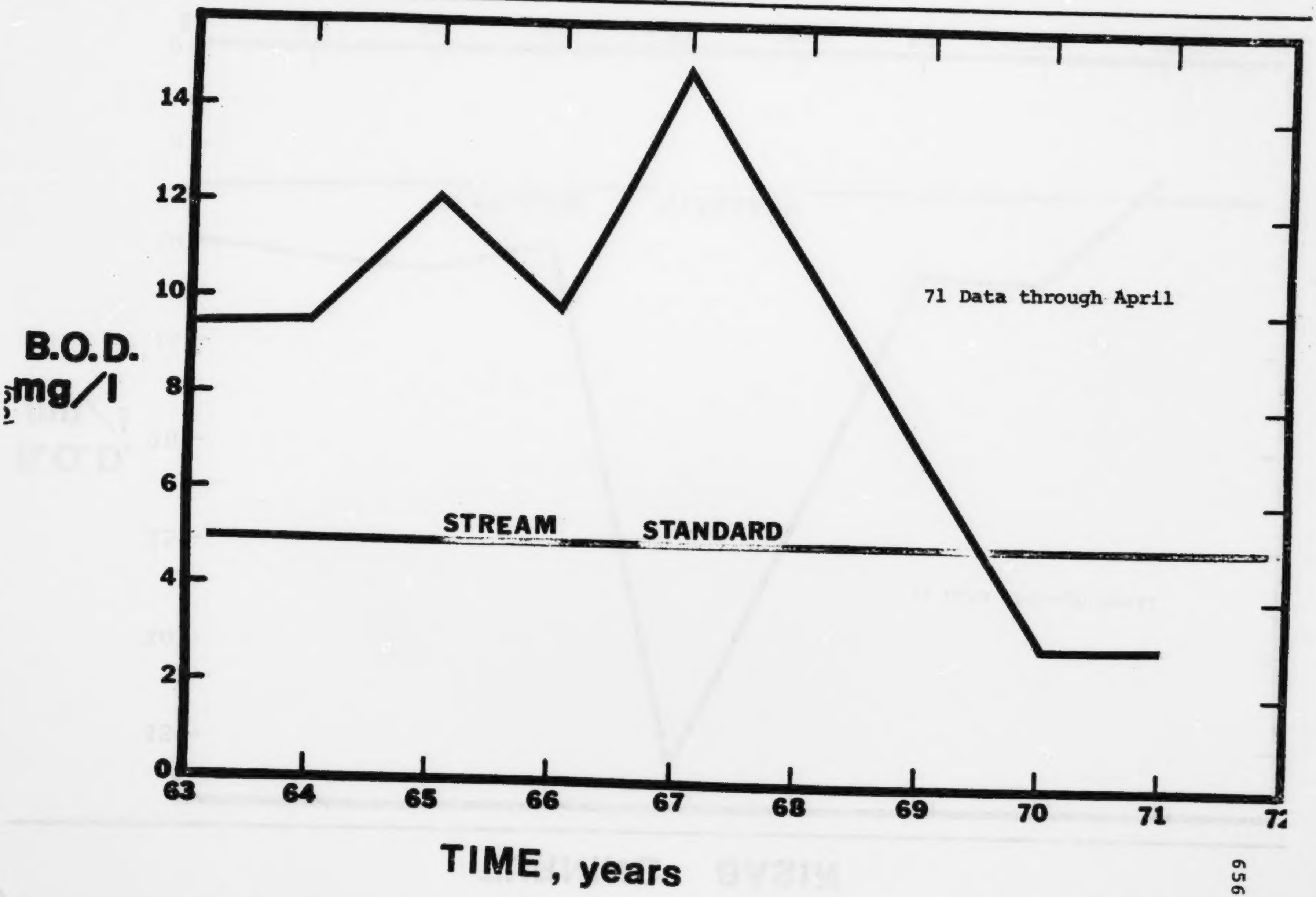
The dissolved oxygen concentration at Morgan Point appears to be responding to these decreased loads. There has been no significant response yet in the upper reaches of the channel and additional lowering of the B.O.D. load will be required.

We anticipate that continued improvements will occur, and that the improvement in the bacteriological quality problem in Upper Galveston Bay west of the channel should be dramatic during 1972.

TURNING BASIN



MONUMENT


B.O.D. mg/l
14
12
10
8
6
4
2
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63
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65
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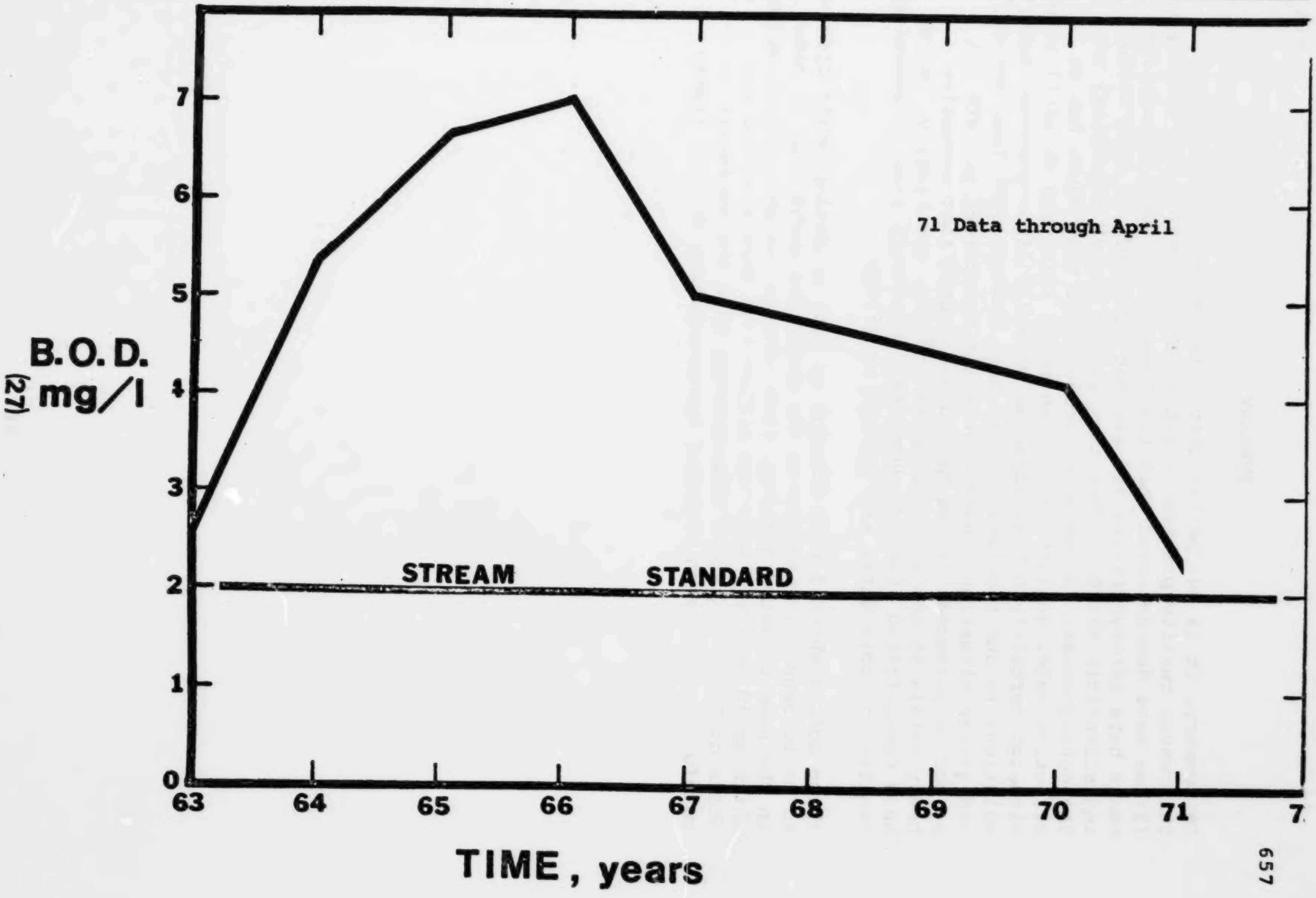
70
71
72
TIME, years
STREAM
STANDARD
71 Data through April

MORGAN'S POINT



(27)

SUMMARY

In summary, it is our belief that: (1) we have demonstrated that water quality problems exist in the Galveston Bay estuary, (2) we have demonstrated that the Texas Water Quality Requirements have idiosyncrasies and are not standards of such worth and scientific validity that they should be met regardless of the consequences, (3) we have demonstrated that Texas has an effective water quality program which is resulting in satisfactory--although certainly not as rapid as we would like--progress toward solutions to our problems, (4) we have demonstrated that the oil and grease situation, insofar as waste discharges go, are not as bad as pictured, (5) we have demonstrated that excessive heavy metals do not exist in Galveston Bay, and finally, (6) we have demonstrated that improvements, admittedly slow in becoming manifest to this date, are in fact occurring.

These points which I have brought to your attention would appear to me to negate any necessity the conferees might feel to take, in the name of water quality, rash, unwise, or precipitous action which would severely harm the citizens of this area and the State of Texas. I would consequently urge the conferees to carefully review each proposed recommendation in this light.

CHAIRMAN STEIN: You know, in listening to Mr. Gallagher yesterday and you today, it is hard for me to believe that you are talking about the same river. (Laughter.) Maybe that is the purpose of the conference. I hope your optimism is shared. Maybe we are going to have fish back in that Houston body of water. Dick Whittington, you went along as if you swallowed a channel cat. (Laughter.) Are there any comments or questions?

MR. WHITTINGTON: Mr. Gallagher and I do agree upon one thing. There is plenty of need for improvement in the Houston Ship Channel.

CHAIRMAN STEIN: All right.

MR. WHITTINGTON: Our difference I think would be on the progress being made.

CHAIRMAN STEIN: I think I heard you at the end -- I think you are not far apart.

What you generally have talked about is the condition of a river. I don't think you and Mr. Gallagher are far apart in your description. But you said much has been done and, within the next few years, we are going to see a substantial improvement.

MR. WHITTINGTON: I think you have already seen, I wouldn't say a substantial improvement, but you have seen an improvement which is substantial in the interest of BOD.

CHAIRMAN STEIN: Right.

MR. WHITTINGTON: The channel has not responded to this load as of yet.

CHAIRMAN STEIN: Yes, sir.

MR. YANTIS: Mr. Chairman, two comments.

First, I think Mr. Gallagher will agree that skiing is more dangerous than heavy metals. (Laughter.)

CHAIRMAN STEIN: I want you to define your terms. Are you talking about water skiing in the Houston Ship Channel?

MR. YANTIS: I am talking about snow skiing up in Denver.

MR. GALLAGHER: I don't eat my skis, Mr. Yantis. (Laughter.)

MR. YANTIS: Mr. Chairman, there is a serious comment.

It is the type of problem we have that we should not have and the type that I hope that Mr. Quarles can overcome.

There was a Clear Lake which was mentioned, and certainly it was shown on several of the maps. It is ringed by approximately 36 discharges. We do, of course, hope some day to have a regional sewer system around it.

There is a story in it, but particularly, we began probably as much as 3 years ago trying to work out the various alternates that were reasonable or feasible.

After a great many public hearings, all of which were fully publicly announced, notice was given practically to everyone, with any number of conferences and testimony and advice from all the competent people that we could find. We issued an order calling for advanced waste treatment at a certain level -- 12 ppm BOD and suspended solids and 1 ppm chlorination, I believe.

Now we picked these numbers not out of any great scientific knowledge, because there was none, but there is not any Clear Lake study as comprehensive as the Galveston Bay study. No one has the -- it is a little, tiny body of water. It doesn't justify a $1 million study. Let's put it that way. And certainly we don't have the $1 million to do it.

So, we knew that we could take an add-on type treatment unit that would do a pretty good job and get a form of tertiary treatment that would bring the BOD down to about 12, get the phosphorus down to about 1, and do what we thought was a first-class job for Clear Lake. And if this is not enough, we can add on another unit. If it is enough, this is fine until we go the next step, which is still a hope -- that there will be a regional system.

But we picked a set of numbers after all of these hearings and we announced them publicly and worked toward them. And then, your people jerked the rug out from under us and tried to say, "No, it has to be 5." As far as we can find out, the only reason is because they can do it at Lake Tahoe. Sure, when they can do it at Lake Tahoe, we can get it to that if that is what we want. We can distill it if that is what we want.

We picked 12, after a long period of negotiations, consultations and evaluations, with your people knowing everything we did every step of the way. Now we are in an argument as to whether the number should be 12 or 5, and I don't think that any such argument should ever exist. I hope that you will instruct your people to go back to the 12 that we think is valid, because we think it is the only number that has had any public scrutiny at any public hearing and has any validity under the circumstances.

CHAIRMAN STEIN: Let me make a suggestion here. I think if all we are talking about is the details, we have never failed to work this out with a State.

MR. YANTIS: It is a detail, but you people are holding up the money.

CHAIRMAN STEIN: I understand. Again, let me suggest that I am not saying it isn't a vital detail or an important one.

Let me say that you people are talking in terms of 5 and 12. It has always been my experience that the best way to get an agreement that everyone can live with is by reducing this, if we can, to pounds per day. I say this on the basis of years of past experience in dealing with municipalities and cities and industries. If we don't reduce it to pounds per day, we very often get into misunderstandings in the numbers game -- 12 or 5 or reductions.

If you are right, Hugh, I think all this will require is a mathematical computation. I am not arguing with your figures at all.

Once we zero in on a pounds per day approach, we can go to a city and industry -- and this has been successful; I am not disputing the other techniques in percentage removal of that 5 or 12; I am not disputing that at all -- and use pounds per day in a similar possible area or as an analytic technique. What I am saying is that our experience has shown that used as a regulatory technique, all officials around know exactly where they stand. We can go the other way.

MR. YANTIS: I do not concur.

CHAIRMAN STEIN: All right.

MR. YANTIS: Let's go on to our next speaker.

MR. QUARLES: I would like, if I may, to ask Mr. Whittington a question or two. Mr. Whittington, I wanted to respond to your presentation and ask a question or two.

First, I would commend you on a thorough presentation, which presented through the pictures and your testimony gave some concrete evidence of the type of progress that I had in mind in my comments earlier this morning.

MR. WHITTINGTON: Thank you, Mr. Quarles.

MR. QUARLES: I also have a few points on which we may not be in thorough agreement. But I certainly was in agreement with your conclusion that the record which exists is sufficient to deter us from adopting any rash or unwise or precipitous action.

MR. WHITTINGTON: We appreciate it.

MR. QUARLES: My own feeling is it doesn't take very much of a record to deter me from rash, unwise or precipitous action. (Laughter.)

The comment you made on the water quality standards disturbs me a little. In terms of pointing out the idiosyncrasies that may exist, I don't know whether you or others have taken steps to amend the water quality standards so that those idiosyncrasies could be eliminated.

MR. WHITTINGTON: Mr. Quarles, that is a thing which needs to be done. But we have so many things we need to do, we are trying to fight pollution, and we felt that a bookkeeping task of this nature can wait.

MR. QUARLES: I think that you indicated that the idiosyncrasies were relatively small, and perhaps not related to the main channel and main problem.

MR. WHITTINGTON: No, sir, that is not true. There is in the lower part of the channel, between Morgan Point and the bay, a BOD value set at 2. This is unrealistic and I don't actually think it is possible in the sense that the measurements which we had made on the Gulf water exceed this. So I don't think it is practical to attempt to meet a BOD criterion of 2 in the lower part of the Houston Ship Channel.

Further, the MPN values which are set for this zone are a median of 40. This is higher than for shellfish water. So I do not think that we are apt to make this.

MR. QUARLES: I would like to simply say that if there are features of the existing State proposed federally-approved water quality standards which have major significance and which are unrealistic or otherwise improper, it would warrant some efforts to consider a revision of those standards.

MR. WHITTINGTON: We would concur with that.

MR. QUARLES: Because in terms of the concerns and objectives and attitudes of the Environmental Protection Agency, we place very substantial weight on the existing water quality standards. We are determined to enforce them and to move from perhaps the past attitude of these being regarded as something simply in the nature of a target. We are determined to have wide acceptance of the fact that these are regulations adopted pursuant to law, and have the force of law, and require satisfaction in the same manner as other legal requirements which apply to businesses and individuals in this country.

I also am concerned over some of the implications in your presentation, and some of the other statements we have heard today, which point not only at the achievements made in which very real pride can be taken -- and that pride of achievement should not become blurred by considerations of where we go from here -- but we are concerned to distinguish from that pride of the past and present achievement and the question of what more needs to be done.

I think, for example, your reference to 83 percent of the companies meeting something equivalent to the base level treatment -- when you are thinking of the Houston Ship Channel and 50 percent only meeting a higher standard -- this is something on which we must set a higher standard of achievement.

MR. WHITTINGTON: Mr. Quarles, I would certainly concur on that, and I thought I very carefully pointed this out. I am simply saying -- or, what I attempted to say and maybe possibly I didn't do it very well -- but the implication in the black book is we don't do anything down here except let people discharge oil. I was attempting to point out that this is not the case.

MR. QUARLES: Well, given in that spirit, I think the point is well taken and I simply want to keep that in perspective and also keep clearly in mind the concern that considerably higher standards may be called for.

In the pictures of the waste treatment facilities that have been installed, you spoke repeatedly of the biological treatment that is being provided there. Do the existing permits and requirements typically call for higher levels of treatment by those industries?

MR. WHITTINGTON: Mr. Quarles, we do not normally address ourselves in what we call the waste control order, formerly a permit, to the manner or method which one utilizes to achieve a certain effluent goal.

We simply direct our attention to the kind of water which can be discharged; not necessarily the means of getting there. Although certainly there is a factor there, because you have to get there some way or other.

MR. QUARLES: That is right. You and we alike are concerned with establishing performance standards.

MR. WHITTINGTON: That is correct.

MR. QUARLES: And leave it to the responsible companies to determine the means of satisfying those standards.

But, all of us are conscious of the types of treatment that will be required, depending on the performance standards which have been established and have to be met. The biological processes of treatment will be sufficient to bring treatment to a certain level, and then reach a ceiling which --

MR. WHITTINGTON: Mr. Quarles, could I say one thing at this point? I don't think that the only viable alternative left is to continually increase the level of treatments.

One has to take into account, I think, the distribution of the waste loads within the estuary. There are also other places which one could conceivably discharge wastewater which would be more amenable to assimilating the waste without oil. This would include the Gulf of Mexico.

I am not suggesting that these are, in fact, solutions, because I am not proposing this and I don't know whether they are or not. But I simply don't think we ought to lock ourselves in to viewing only continually increasing levels of treatment as being the only possible solution.

MR. QUARLES: I think that it is well to keep an open mind as to what will solve the problem most effectively. But the question I have in mind is whether, in your judgment, the installation of the biological treatment facilities, of which you showed us a number of pictures, is a sufficient answer to the problem we have in front of us.

MR. WHITTINGTON: Mr. Quarles, I frankly don't know.

You and I and everybody here who has fooled with mathematical models on predicting what is going to happen in a natural environment -- we know when you lower the waste load to this or that, I think in general, the history of these models has been rather dismal in their accuracy. So I do not know, in fact, how the channel is totally going to respond.

The Galveston Bay Study is directed at attempting to try to find this out. So I would not be prepared at this point in time to say that we cannot bring about at least in the foreseeable future -- and, again, depending on what one considers to be an acceptable situation -- in the channel.

I would not say that it could not be obtained with biological treatment facilities. I simply don't know.

MR. QUARLES: Well, we may be pushing this as far as it can productively be pushed right now. But in reference to your own uncertainty as to what can be achieved and your hopes, as you expressed them a few minutes ago, that we will soon begin to see some results in the improvement of water quality ---

MR. WHITTINGTON: I think that is true. I think it has already happened to some extent.

MR. QUARLES: I simply want to leave in the record an indication that our best technical people do not share the same degree of confidence in the improvement of the water quality which will result from the treatment facilities now scheduled. I will hope that there will be this very intensive working together to go over the subject by your people and ours to see if a common judgment can be reached on what more may be required. I have a fairly strong personal conviction that a good deal more will be required.

MR. WHITTINGTON: Mr. Quarles, so far as I can speak for the board, we will be delighted to work with your folks.

MR. QUARLES: Thank you again. I commend you on your presentation.

CHAIRMAN STEIN: Sir, I think there is one point I would like to drive home here, not only because it refers to Mr. Quarles' question, but because it may be a good portion of the problem we have here.

This relates to one of the questions he asked you. The point is, we have Federal water quality standards which were sent in to us by the State and approved by either the Secretary of the Interior or the Administrator of the Environmental Protection Agency.

Let's suppose we take one standard such as this that Mr. Quarles and you have alluded to, 2 ppm of the BOD in the lower reaches of the Ship Channel.

MR. WHITTINGTON: That is all right.

CHAIRMAN STEIN: Now, if you say this can't be achieved, and you have put out your permit in that sense, and you say the changing of this is just a bookkeeping operation -- which is one kind of approach -- but the Federal Government is using this dead seriously as base for its entire program, I am not sure you can count this as a bookkeeping operation.

But I think that if these are our attitudes, we are going to face precisely the same difficulty that we have here merely because of the kind of thing you are sure of and you don't think is important. You are issuing permits for ostensible violations -- something which can't be met -- and the Federal Government thinks that this is the chart of what we have for these waters: it is inevitably going to bring something like this about.

I think this is something we both have to think about very carefully if we want to avoid confrontations such as this, and this may be a good portion of the ostensible misunderstanding that we have here.

MR. WHITTINGTON: Mr. Stein, I do not mean to imply that we do not consider the water quality requirements as important. We certainly do, particularly in view of the emphasis which is placed upon them by the EPA.

I simply said that in the instance of the Houston Ship Channel the problem is so great that I do not think we should take time from trying to fight this problem at this time to go through the public hearings, etc., necessary to amend these water quality requirements.

I am hopeful that we will be able to in our upcoming budget, since we will have many more people.

CHAIRMAN STEIN: Yes, sir, I understand your point well and don't want to belabor it. I just ask you to think of the consequences of your situation. This is what brings us here today. This is part of what we are going to try to think through with the State in order to get closer, because I think this is a very vital point in the program. Thank you.

MR. QUARLES: I have one comment.

MR. WHITTINGTON: All right.

MR. QUARLES: The requirements of water quality standards are exactly the issue on Clear Lake.

The State clearly says diversion of effluents from Clear Lake. Then they come in with a permit to discharge treated waste with an effluent of 12.

My only alternative to recommending denial of this permit is that it is receiving the best available treatment.

MR. YANTIS: Just a minute.

First of all, there is nobody in the United States -- in Federal service, the university systems, or anywhere else -- who has sufficient wisdom and technical knowledge to write an ideal water quality standard for any place at anytime, except maybe a bathtub, where the quality never changes.

We have the statistical problem of reflecting the varying quality that occurs from minute to minute, day to day, year to year. You have different flow patterns. There are literally thousands of tests from which you can select, and all of this has got to be wrapped up in something for which you basically had no data in the first place. And so, every water quality standard in the United States is about 1/3 science, 1/3 guess and 1/3 negotiation.

They are, as Dick said, not sacred, and anyone who thinks that they are sacred simply doesn't understand the problem.

Now, when you look at a set of water quality standards -- I will digress and put it this way -- I saw a television show one time where the man that took Senator McCarthy apart was the host, a Mr. Welch, and someone had asked him about the United States Constitution. And he showed him a picture of it hanging on the wall and he said, "Now the average layman thinks that is the United States Constitution," and he turned to the other wall and it was just full of Supreme Court decisions. He said, "There is the United States Constitution."

Now when you look at water quality standards, anybody's water quality standards, you are looking at a shorthand guide at the very best. And unless you have a university full of technical books for disciplines of every kind, you can never possibly interpret them intelligently, and anybody who thinks they are simple as arithmetic is absolutely wrong.

Now when we wrote the Texas Water Quality

Standards back -- it began in 1965 and had them finally adopted in 1967 -- there was very little known about tertiary treatment, and that which existed was experimental and probably controversial. There was certainly none of it in Texas, and none of it was expected to be in use on a routine basis for a long, long time.

But we knew then that Clear Lake would never be as clean as the people wanted it with all of those conventionally treated sewage effluents going into it, because everything we did was geared around conventional treatment. So we simply suggested that the numbers we are saying here be the numbers that would some day be met if the sewage effluents are not in the Lake. This was not a plan; it was not a regional plan; it was not a commitment to the Federal Government or anything else. It was just a little sidebar comment that said, "Now don't expect these numbers to be met until we can get the sewage effluents out."

Now we have found since that the tertiary treatment might do it, at least on an interim basis, and I did raise the question by telephone with one of the Assistant Commissioners in Washington.

He said this problem would have to come to his desk and had never come to him, and he didn't know what the argument was all about. As far as I know, he still doesn't.

But I don't think there is any violation of anybody's standards for the Clear Lake watershed upon which you can hang any comment that says you have to deny something. You are simply standing in the way of Texas progress. (Laughter.)

CHAIRMAN STEIN: Any comments?

MR. VANDERHOOF: Plenty, but not here.

CHAIRMAN STEIN: I didn't know of anyone trying to do that since Santa Anna. (Laughter.)

MR. YANTIS: I think this is an appropriate point since interim planning and planning in general was one of the subjects talked about yesterday.

Since this is an oyster conference, we didn't quite see a lot of the regional engineering planning was necessary. So, we didn't bring many down. Since some of the comment got involved in regional planning, we asked someone to come down and he is here today. Mr. Bob Fleming, who is in charge of all of our planning and the grant programs and things like that, will address us now on his part of the program.

CHAIRMAN STEIN: First we will take a short break.

(Whereupon a recess was taken.)

MR. YANTIS: Will each of you please take his seat, if we want to put this in good grammar.

Whoever runs the telescope up here on my desk, I think the red light went out, so I don't know whether it is working or not.

While you are finding your places, because of human limitations, both as to mind and body -- the brain can absorb only as much as the seat can endure, you know, that sort of thing -- and the secretary down here gets tired too, we will quit at about 5:00. And we will have, unless we run a little bit long -- we will hear from Bob Fleming; then from Gene Rorack on behalf of the Gulf Coast Waste Disposal Authority; then from someone on behalf of WCID No. 50; then Jerry Coleman on behalf of the Houston-Galveston Area Council; and then Mr. Ed Falk of the Clear Creek Basin Authority; and then Cecil Reid of the Sportman's Clubs of Texas.

Now we might not make that by 5:00. I may have to quit with some of this undone, but we will reconvene in the morning and begin in the morning with the statements which were a part of the Texas presentation, or we will begin with any portion of what I just read that we do not finish. But I just bring this out so that you can kind of schedule your own mind as to what is coming.

UNIDENTIFIED SPEAKER: What time tomorrow morning?

MR. YANTIS: Well, the Chairman here likes 9:30, unless he changes his mind.

CHAIRMAN STEIN: I think we will start at 9:30. I think you just kid yourself when you say you are going to start at 9:00. You don't. We will start at 9:30 and we will do it on time.

MR.YANTIS: All right. I used to have a friend who was a Director of a Little Theater project and he said, "The curtain goes up at 8:00 whether there is anybody on stage or not."

Well, Mr. Bob Fleming, for the Texas Water Quality Board, will talk on the engineering aspects of his work which is the Federal grant program, administration planning, and other technical matters within the central office primarily.

Mr. Bob Fleming.

MR. BOB FLEMING
TEXAS WATER QUALITY BOARD
AUSTIN, TEXAS

MR. FLEMING: Mr. Chairman, conferees, ladies and gentlemen. I would like to cover the construction grant projects in the area first. These remarks will be brief. They will pertain only to the construction grant projects in this immediate area.

Construction of sewerage facilities in the area has been accelerated significantly in the past 2 years. This acceleration is shown by the 1-year and the 5-year project needs lists furnished to EPA in the program plan from the Texas Water Quality Board. Most projects shown on the 5-year list submitted in July 1969 for construction within 3 years period of time have been accelerated and were on the 1-year needs list for last year or, are on the 1-year needs list for this year.

Wherever possible, maximum use has been made of the reimbursable provisions of the PL660 construction grant program. In fact, at present, there are 8 projects totaling over $1.5 million in construction in the immediate area which have proceeded on a reimbursable basis and have not as of yet received their Federal grant.

The city of Houston has also utilized the reimbursable provisions to construct waste treatment facilities as early as possible. Last year Houston added 42 MGD of treatment capacity at a cost of $7 million. They presently have underway improvements to add 16.5 MGD additional treatment capacity at a cost of $11 million. This current expansion is being accomplished with the aid of some 6 construction grant projects, 5 of which were delayed for some 7 months after the State issued priority certifications before EPA funded these programs.

One of these projects was delayed for 15 months after State certification.

All Houston sewage treatment plants presently provide chlorination with the exception of Sims Bayou plant. This was alluded to earlier. Chlorination facilities are presently under construction as a part of the construction grant for enlargements to this plant. This particular project is one of those that waited for 7 months for EPA funding.

With the present construction, Houston can abandon 7 more small treatment plants by diverting the sewage into subregional plants. By 1972, 30 MGD additional capacity will be available in the Houston sewerage system, making the total capacity in excess of 200 MGD.

In the immediate area, there are currently 18 projects with construction grants, which are in varying stages of completion. There are 8 projects under construction with grants pending under the reimbursable provision of the PL660 program.

Applications for grants have been received by the State agency for approximately 18 additional projects in this immediate area which are currently under review. It is anticipated that priority certification will be issued for these projects as the review is completed.

Most of these projects will be ready for funding out of the Federal Fiscal 1971 funds. These projects are also subject to newly enacted State financial assistance.

Now, I will speak for a moment about the status of interim basin plans of the area.

A contract was signed with the Houston-Galveston Area Council in December 1968 to develop a comprehensive plan for area-wide sewerage facilities in the immediate 8-county area. The objectives of the plan are to develop information on the feasibility of area-wide sewerage systems and to formulate a definite program to correct current and future deficiencies.

To accomplish the objectives of the study, the work was divided into several phases, including:

1. A survey of and analysis of exising facilities.

2. A survey and analysis of existing water quality.

3. Preparation of population projections for the years 1970, 1975, 1980, 1990 and 2020.

4. Analysis of waste treatment needs by sub-areas for years corresponding with the population projections.

5. Conceptional design of area-wide sewage and waste collection and treatment systems.

6. Develop proposals for system implementation.

7. Prepare a general financial program for implementation.

All of the basic data in this planning effort had been gathered and the writing on the conceptional plan had begun when the Federal requirement for interim plans was established. A copy of the Federal requirements was furnished to the planning contractor with the request by us for him to incorporate these requirements into the plan where possible without delaying completion of the effort.

In January 1971, advance review copies of the planning reports were furnished to the Texas Water Quality Board. These advanced copies have been reviewed. Preparation is now under way to subject these planning reports to a public hearing in the area to receive maximum input from the citizens and political subdivisions of this area who will be governed or regulated by these plans. It is anticipated that the formal public hearings, plan adoption and certification will be accomplished either in July and/or August 1971.

This schedule will allow the State to comply with the interim plan requirements and commit Federal construction money to projects of the area in sufficient time to prevent lapse of these funds and meet construction schedules. At the present time, no construction is being delayed because of the lack of interim planning.

In a Seminar on Federal and State planning requirements last week, June 4, 1971, sponsored by the Houston-Galveston Area Council government, a representative of the Environmental Protection Agency's South Central Regional Office stated that Texas is ahead of most of the States in the Nation on area-wide sewage planning. This is borne out by means of 16 other planning contracts similar to the one in this area of the State. Texas has covered 82 percent of the population and 51 percent of the area of the State with these area-wide sewerage facility plannings.

Thank you, sir.

MR. YANTIS: Bob, yesterday we discussed quite briefly the number of regional interim plans approved in other parts of the United States. I believe you said the number was 2 or something like that. Will you repeat that comment?

MR. FLEMING: I am not for sure how many have been approved throughout the Nation.

In the State of Texas, we have gone through a formal public hearing on 3 area-wide sewage plants, which have been submitted to the Governor's Office with a request for his certification and formal submittal to the Regional Office of the EPA.

There will be another plant hearing before the Texas Water Quality Board with similar recommendations and forwarding to the Governor's Office at the board meeting next week for a total of 4.

MR. YANTIS: I am talking about planning in other parts of the United States. We had a comment last night.

MR. FLEMING. I could not answer how many have been approved in other parts of the United States. I am personally not aware of any that have been approved in any other part of the country.

MR. YANTIS: If there are no questions, I asked Mr. Fleming to come down solely because the presentation yesterday sought to make quite a point of the fact that Texas was seen to be somehow deficient in its planning and its interim planning. I do not believe that it is.

The next speaker, and I am very proud to introduce him, is General Royal Hatch on behalf of the Gulf Coast Waste Disposal Authority.

Please remember my earlier comments. This Authority was organized by the Legislature at the time when John Connally was Governor of Texas. He is now the Secretary of the Treasury.

It grew out of some suggestions by the Federal Government when Mr. Jim Quigley was commissioner of the Federal Water Pollution Control Administration.

So it is not only a State idea and a local idea, but it is a Federal idea as much as anything else.

It was intended to give the local people, on a much larger basis, and the city and county a voice in the conduct of their waste disposal affairs.

General Hatch is either the Chairman or the President of the 9-member board and he can speak to you about the Gulf Coast Waste Disposal Authority in more detail on the reasons for its existence, its plans and and anything else that he thinks is pertinent. And I do think that it is an important creation of the State.

B/G ROYAL HATCH, Rtd.
GULF COAST WASTE DISPOSAL AUTHORITY
HOUSTON, TEXAS

B/G HATCH: Thank you, Mr. Yantis.

Mr. Stein, members of the joint conference, ladies and gentlemen, I appreciate very much this opportunity to report to you gentlemen and to my neighbors here the results of what I like to think of as, perhaps, Texas latest exhibits of innovative thinking in the field that we are all involved with.

In the few months of our existence, we of the Gulf Coast Waste Disposal Authority have visited throughout the State in an attempt to discover other regional agencies who may represent a prototype for the solution for some of the problems we face. And we find our agency to be rather unique; there is nothing just like it in the country. I must compliment the Legislature and the Federal Government, as it now appears you have armed us with tools to do the job on a regional basis locally.

We, the 9 men who constitute the board -- my colleagues, of course, are nonsalaried -- and we have much at stake. We think very deeply about what we are involved with. We live here. We want to leave it better than we found it. We know that we face what the general public now, I think, very recently perceives to be the number one domestic problem in these United States and it was mentioned earlier today, and, as such, we understand it to be a very, very tough problem.

But we would like to adduce today, Mr. Stein, that it is not all bad and that some work is being done, and being done well, and that at the very least, if we end these most interesting days today and tomorrow with a resolution to coordinate our actions, you gentlemen on the Federal side, Mr. Yantis and his colleagues on the State side, and, we on the regional side, that this is a must. Because already in our short life, we discover far too much lost motion, far too much confusion and rock throwing and we, with others, are faced with a crucial local problem.

What is the Gulf Coast Authority? It was formed in late 1969 by the Texas Legislature with the advice of counsel that you have heard.

Our staff, our permanent staff, is less than a year old. The Texas Legislature gave very sweeping regional powers to this entity for the 3 counties of Harris, Galveston and Chambers. These 3 counties embrace 95 percent of the area of Galveston Bay. It is embraced by those 3 counties.

B/G R. Hatch

We are charged with the development of a master plan. I think we are going to have a great deal of help in this regard. We are required to set standards, but subject to the approval of the Texas Water Quality Board.

We have sweeping enforcement and policing powers. We can also condemn land, and we can own and operate facilities financable with our own bonds.

We can be a taxing authority subject of the vote of those to be taxed.

There are, as I mentioned, 3 directors from each county, nonsalaried, a small but expert professional staff, and we discover ourselves to be a prototype of the entity that Mr. Yantis mentioned.

Just in passing, we also can assume responsibility for solid waste management in the 3-county area whenever the board feels we are man enough to do it.

As you may imagine, Mr. Stein, it has been a frantic year. We think we have made a solid beginning, and I must not leave the impression that the improvements of which we speak began with us because they did begin earlier, and I think 1967 would be a good year for the road back to have started.

But, early on, we decided on priorities and we established a cleanup of Galveston Bay and of industrial wastewater management in and around the Houston Ship Channel as our number one problem.

The addressing of this problem that we have done in the last year has been 100 percent industry financed including overhead charges to the Gulf Coast Authority. In brief, here is our area.

[Slide.]

And these 3 counties embrace, as you see, the bulk of the bay, the matter of concern of the last 2 days.

Insofar as pollution going into Galveston Bay, 60 percent of it is probably from industrial sources in and around Houston and the Ship Channel, perhaps 10 to 20 percent is from the Texas City area.

[Slide.]

We have two regional combined industrial treatment plants now in process. The treatment plants represent $30 to $40 million worth of capital assets. They will be completed and on stream in a matter of 18 to 24 months and will substantially reduce the BOD load as well as oil and grease into the Houston Ship Channel.

We believe that project number one, which you see there, will remove roughly 30 percent of the BOD channel loadings that are known at the present time.

The first project includes these 5 industries, seen depicted here in a regional system, and this system has completed Phase One which is an analysis of the compatibility of the waste to be treated in a combined or regional fashion.

Incidentally, Phase Two is engineering and costs and Phase Three is the contracting phase.

[Slide.]

Here are the industries which are contributing their money to this combined treatment plant, Gulf Coast Authority No. 1.

[Slide.]

Champion Paper plant.

[Slide.]

Crown Central.

[Slide.]

Atlantic Richfield.

[Slide.]

Goodyear.

[Slide.]

Petro-Tex.

And now, gentlemen, in addition to these 5, Armco will be able to use the facilities of this combined regional system subject to the solution of certain of the other problems which you read about in the paper. But the treatability of those wastes has been determined to be completely compatible to this system.

From a technical point of view, there is no need to discuss further injection wells or any other system because we and these industries can accomplish the treatment perfectly well and get good results.

[Slide.]

We have BOD loadings of 120,000 pounds at the present time, 16,000 pounds after treatment and 88 percent reduction on 60 MGD .

Combined Treatment Plant No. 2, at present, has only one customer, but has the capacity for the addition of others.

The Ethyl Corporation plant will be Gulf Coast No. 2 and it is in Phase Two which is the detail engineering and cost phase.

The results will be 2,000 pounds of BOD, 2,100 pounds to be exact, 160 pounds after this system is on stream and a 92 percent reduction in BOD loadings on 4 MGD.

Gulf Coast Authority Project No. 3 is Union Carbide in Texas City.

[Slide.]

This is in Phase Three, the detail contracting phase. We have secured a permit from the Texas Water Quality Board.

The result is 135,000 pounds of BOD loading -- not into the Ship Channel, mind you -- that was before. 18,000 after and a BOD reduction of 87 percent on 13 MGD, and when the inplant improvements, which are a companion piece to this treatment plant, are added, the BOD reductions amount to over 90 percent.

Here, again are shown all 3 systems and the area in which our major activity has been concentrated.

[Slide.]

A total load reduction on Galveston Bay is shown here by virtue of these 3 systems which was one of the major reasons for the existence of our agency.

[Slide.]

The BOD loadings will be reduced 30 percent roughly to Galveston Bay. You will say and we will agree with you that this is not enough and "What about the balance of the 70 percent?"

Gentlemen, we envision a 10 percent program, and I am sure you do too, with the expenditure of $400 million to $600 million worth of industry's money which we will coordinate, guide and govern, and we say that is a pretty damn good start.

I must say, although there are some industries here which may still need the work, that, by and large, Texas industry in this area appears ready to spend its money.

The industries I mentioned, 9 of them, came to us willingly, 2 of them before we were even formed and in existence.

I think it is fair to say, and, I would hazard a guess that this can be said nationwide, that industry generally knows that time has run out. They do, however, require and have a right to several clear, crisp guidelines, and we feel it our responsibility with you gentlemen to give them to them.

I think, in turn, they will perform, but they do require from government the guidelines and criteria on which they must perform.

B/G. R. Hatch

Gentlemen, our activities here are not just in the industrial field; Texas has not negotiated the domestic problems as you have heard before.

[Slide.] (See pp. 698a, 698b, 698c, 698d, 698e.)

This is from the EPA's own data from a presentation made by the EPA a month ago. These are the watersheds in this county which, in effect, are doing more than just taking the lumps out of the domestic sewage. (Laughter.)

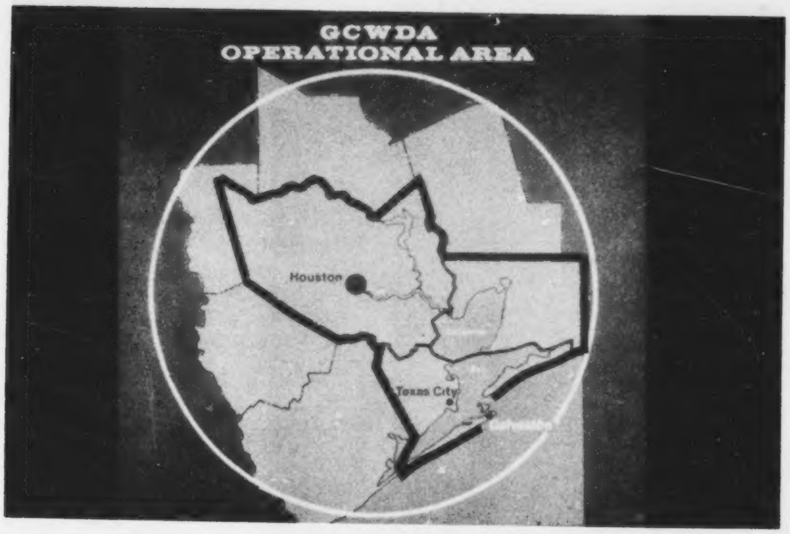
And Texas would certainly appear to be the best equipped State in the Nation in this regard.

I think it was mentioned earlier today that this program has been in effect for some 10 years and this is the result.

Can I have the lights, please?

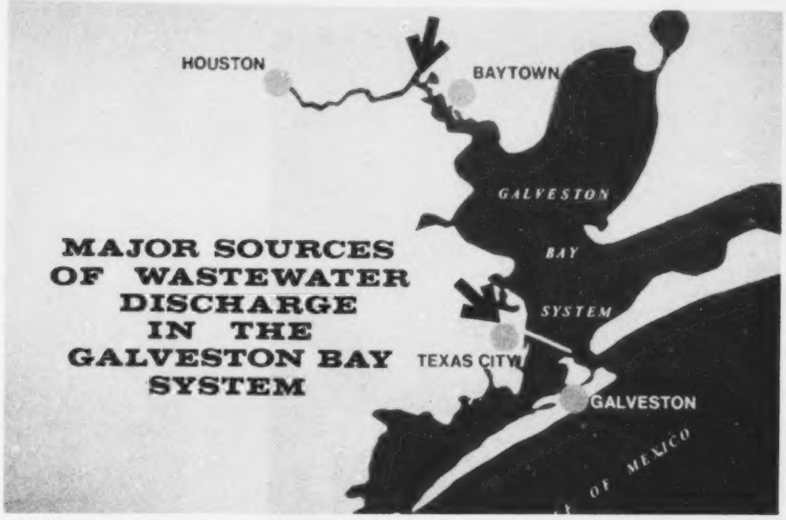
The Clear Lake problem was mentioned awhile ago, and we, while adding our limited resources to the problem I just mentioned, have been working hard in this regard as well. And it is a fascinating, technical question: Is the tradeoff between regional systems one of diversion or one of advance waste treatment?

This, on a technology basis -- which I do not think is completely adequate yet -- it boils down to



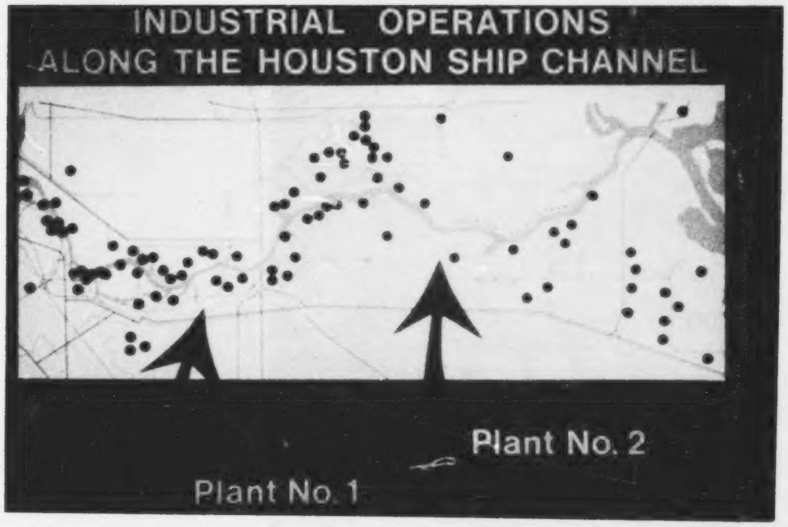
GCWDA
OPERATIONAL AREA

Houston
Texas City
Galveston



MAJOR SOURCES
OF WASTEWATER
DISCHARGE
IN THE
GALVESTON BAY
SYSTEM

HOUSTON
BAYTOWN
GALVESTON
BAY
SYSTEM
TEXAS CITY
GALVESTON
OF MEXICO

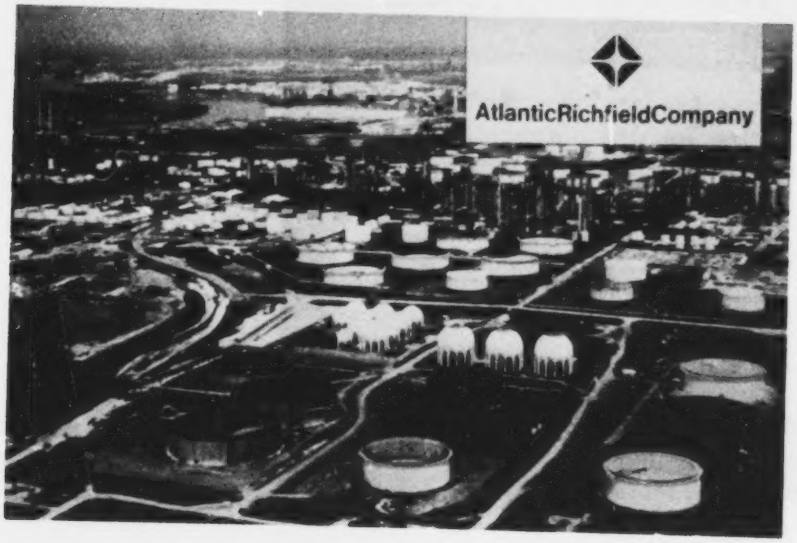


INDUSTRIAL OPERATIONS
ALONG THE HOUSTON SHIP CHANNEL

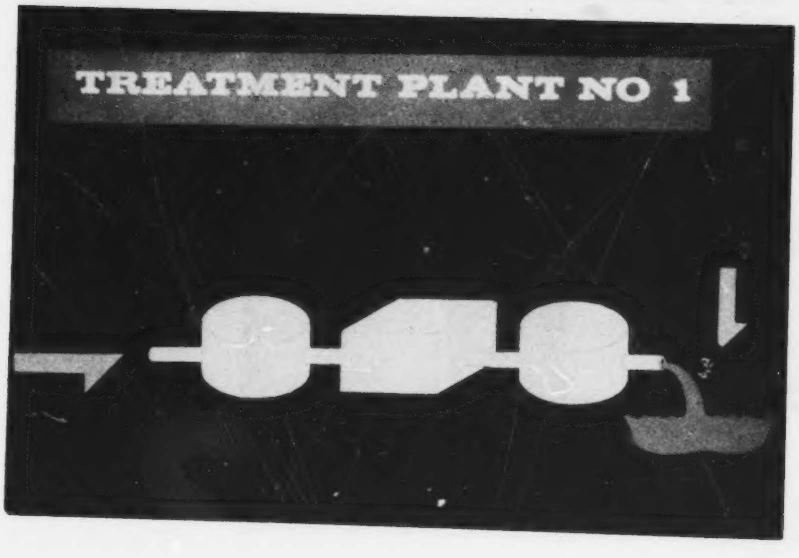
Plant No. 2
Plant No. 1

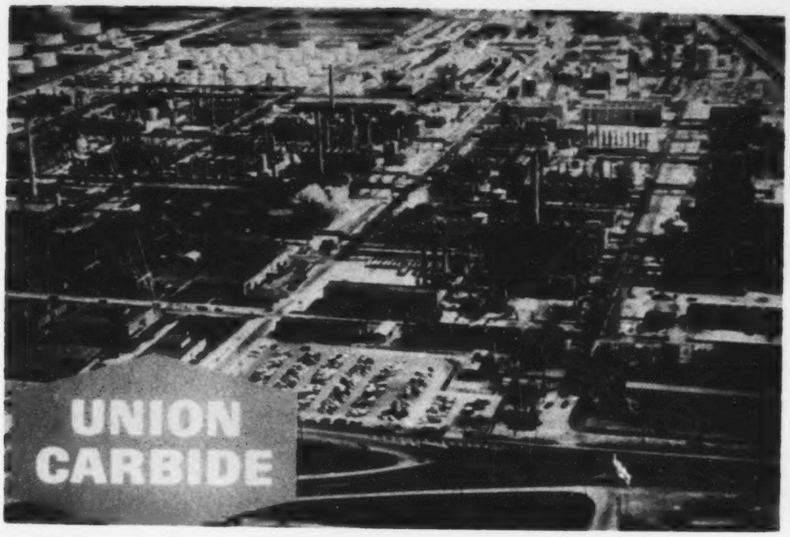
CHAMPION PAPERS

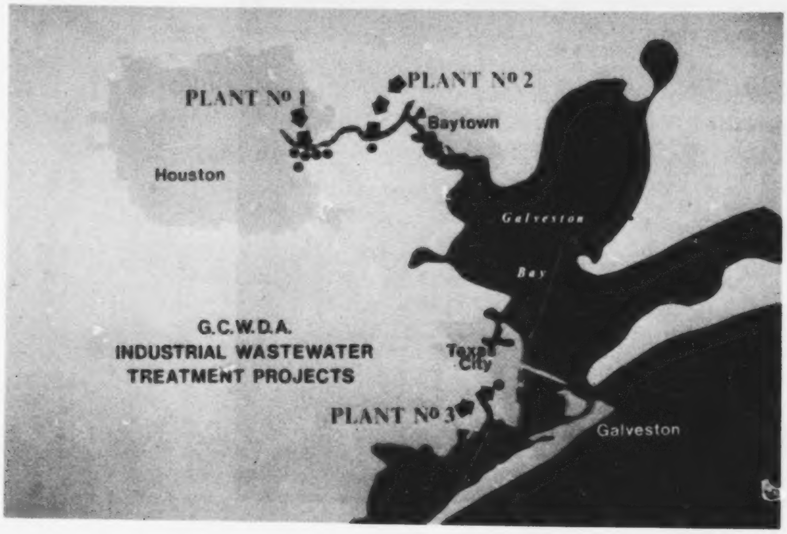
CROWN

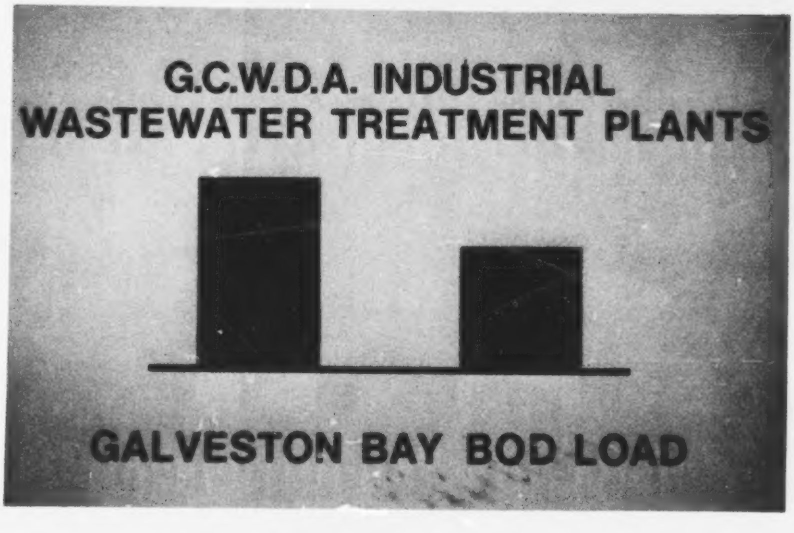

AtlanticRichfieldCompany

Petro-Tex

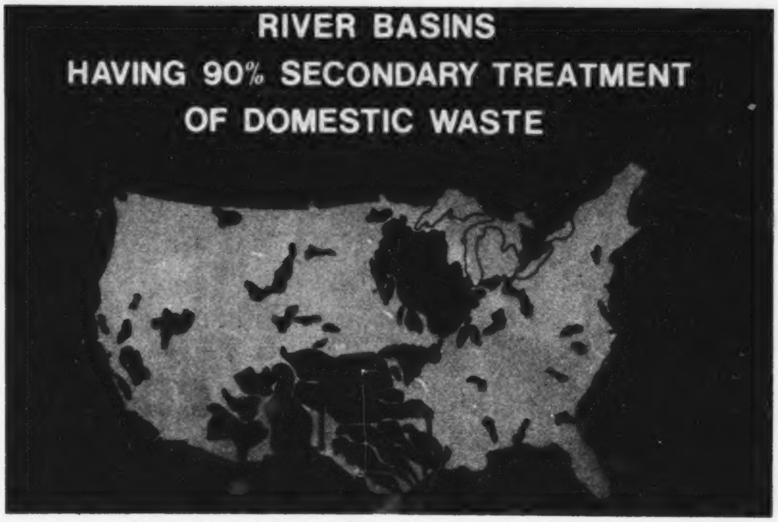

TREATMENT PLANT NO 1


UNION
CARBIDE


PLANT Nº 1
PLANT Nº 2
Baytown
Houston
Galveston
Bay
G.C.W.D.A.
INDUSTRIAL WASTEWATER
TREATMENT PROJECTS
Texas
City
PLANT Nº 3
Galveston


G.C.W.D.A. INDUSTRIAL
WASTEWATER TREATMENT PLANTS

GALVESTON BAY BOD LOAD



RIVER BASINS
HAVING 90% SECONDARY TREATMENT
OF DOMESTIC WASTE

a matter of time. When is the right time to abandon individual plants and go to combined situations, particularly when you have advanced technology available? I speak of the NASA area where we have some brilliant scientist availability to these systems and some of the gentlemen involved are sitting here today.

If advance treatment will work anywhere, it is going to work there. But economically it doesn't make sense over a long pull. The question is when to make the tradeoff, and we have been involved in helping these entities, and helping you, if you will, and the State, with some detailed local knowledge.

In the meantime, several of the permit holders, the cities involved, have asked the Gulf Coast Authority to operate these treatment plants for these cities, feeling that by combining the training of these operators we can furnish both an improved quantity and quality of personnel.

We are adding this at this moment and we think it shows promise and we may be involved with other entities a great deal in the next few months.

There is a very heartwarming aspect of the work in the Clear Lake area and that is why for 2 days a half a dozen high school students have been sitting in your audience. They left a moment ago, but they voluntarily, for some years, have been sampling the effluents in the Clear Lake area after school and on the weekends and working for us and with us in that regard. There is now a more elaborate project for summer employment for them, but their technical outputs are entirely reliable and we are using them as a basis for a data base.

Considering now other activities in the nonindustrial field, the Chambers County problem -- the area which contributes the pollution to Trinity Bay -- is simply one of there being no sewage facilities at all in Chambers County. They have asked for our assistance, advice and counsel on both financial and technical questions.

Finally, the cities of Galveston and LaMarque have asked us for technical advice on the solid waste problem, a problem I said we probably would not be addressing for awhile, but the requirements are there.

B/G R. Hatch

We are asked these questions. We are the local agency and we are attempting to step up to the problem.

Looking to the future, Mr. Stein, what are the best ways? The cries are from these agencies here, from this area here. What is the best way to do it? How soon? It has been mentioned that we really don't know what is happening in Galveston Bay or what will be the results of the improvement efforts that are being done now.

It lies nearly in the State of New York to have real time monitorship in the bay, as you know.

We do not find such a system anywhere in the United States. The system on the Ruhr Valley is not the system that would be necessary to get the answers that we need.

If you know of a real time monitorship system anywhere, we would be delighted to hear of it, but this is what is needed to really check progress here locally.

I am confident we will see it in the next 5 or 6 years, but this is the kind of thing we feel we are sent here to do and we wish to do it.

CHAIRMAN STEIN: I can go off the record on that.

(An off the record discussion was held.)

GENERAL HATCH: We also, as I said, have enforcement powers. I am not sure that they are necessary. It looks like other entities are deeply involved here. (Laughter.)

We would not want to add unnecessary efforts. We can and will if needed.

I mentioned that we visited elsewhere. We have looked at Seattle Metro, Los Angeles Sanitary Commission -- and were disappointed there, by the way, with that 110 inch pipe going into the Pacific and it is not what we consider waste disposal.

(Laughter.)

CHAIRMAN STEIN: I can go off the record again.

(Off the record discussion.)

GENERAL HATCH: While recognizing the

B/G R. Hatch

fantastic road ahead of us, we are encouraged at our start. We feel a weight of responsibility for more than just the problem at hand. We think it is likely that regional entities like ours will be the ones, the apparatus, to address other large area questions such as law and order, mass transit transportation, not to mention environmental problems. We want to show this can be done in this way most logically.

As I say, I am distressed at what we have perceived to be much too much lost motion among the governmental entities of which we are one. We think that guidelines are a must and that the taxpayers and consumers will not long be patient with confusion about pace and timing, how often and how much to do.

We know it is not enough to file lawsuits because industry can do it without such a fray provided they know what to do.

I will close with some words by Henry Cabot Lodge, the author and statesman, who said that, "There can be no doubt that increasingly during the 1970's, industry will be subjected to mounting pressures to abandon 'the single-minded pursuit of profit and take on purposes linked with broad public responsibility.'"

These pressures will come from youth, ethnic groups and the public in general, and you, ladies and gentlemen, feel and hear those pressures in Houston today.

Industry can only do so, however, in partnership with effective government in conformity with a new ideology which will better define and order the task at hand and set forth the criteria for the partnership itself.

Gentlemen, we welcome the partnership with you. We have much to do. The problem will be long, but I think at least we have made a start.

Thank you.

(Applause.)

CHAIRMAN STEIN: Would you wait? I have a question. May I just ask a question or two?

GENERAL HATCH: Sure.

CHAIRMAN STEIN: I take it that you have both operating and enforcement authority?

GENERAL HATCH: That is correct.

CHAIRMAN STEIN: Presumably you can construct the plant too?

GENERAL HATCH: Yes, sir, we can.

CHAIRMAN STEIN: Now, who is the constructor, owner, and operator of the Plant 1 and 2 you indicated?

GENERAL HATCH: We are.

CHAIRMAN STEIN: You are, of these two plants?

GENERAL HATCH: Right. In this connection, we would seek and get a permit just like any other operator.

CHAIRMAN STEIN: Yes, but you have not used your tax base for this plant?

GENERAL HATCH: As I say, 100 percent industry financed, 100 and some odd percent.

(Laughter.)

CHAIRMAN STEIN: Well, that is part of a 100 percent.

GENERAL HATCH: Right.

CHAIRMAN STEIN: If you have been with the Government, if you have ever convinced an industry that you plan them 100 and some odd percent, they would never do it.

GENERAL HATCH: That would be very helpful.

CHAIRMAN STEIN: You know, one time a week or so ago, I was out with an industry representative for lunch and they all grabbed for the check and I did too, just to make a show -- (Laughter.) -- and one guy said, "Let me pick it up; I am in the 50 percent bracket." The other guy said, "Heck, no! I am in the 90 percent bracket," and the third one grabbed it and said, "No. Give it to me. I have a contract with the government. I am going to make 6 percent on it."

(Laughter.)

Let me say that I have one question and one brief comment. I think in looking at what we are faced with in the country, your plea for criterial guidelines or standards, or what have you, is very important.

Now we have a device here in this conference tonight and to paraphrase W. C. Fields, "Anyone who calls an enforcement action involving Texas can't be all bad." I know what your reaction is to this, but this is a device where we can all get together, and I mean all -- industry, municipalities, regional agencies like yours, and State and Federal Governments -- and come up with an agreed-upon figure that we can all live with. Without that, and with this proliferation of enforcement powers that we all seem to be getting, we are just going to meet ourselves coming and going. We have to try to work this out.

I don't want to pursue this. But I specifically raise it and hope someone else will bring it up. You mentioned that your Plant No. 1 could receive the waste from Armco and deep well disposal was no longer necessary. That is a pretty significant statement. Somewhere along in this, if anyone else has any comments on this, we would like to hear them.

MR. YANTIS: I will make the comment that they are on opposite sides of the Houston Ship Channel, and we have not decided whether or not they can cross the channel, or whether or not there will be a contract. There was a lengthy interview with a newspaper about a week ago, and the matter is in Federal Court right now.

CHAIRMAN STEIN: That is right.

MR. YANTIS: All we have done is to express to everyone our willingness to try for the best possible solution. Whether we have already found a solution or not, we do not know.

Deep well injection is a solution, but there may be others and we are still looking. The deep well injection would be much quicker, much quicker, and this is a key point.

If we are going to go some other route, we may be adding a year to the time. But, unless there have been some decisions made in the last day or 2, all that we have so far is a good faith effort to see whether this course can be followed. There has been no decision that it can be followed or that it should be followed.

GENERAL HATCH: Mr. Yantis, all I intended to say was that we have examined the wastes, and they are compatible with Gulf Coast's Plant No. 1 process. They can be treated that way, and insofar as the timing and delay is concerned, well, I will leave it at that.

CHAIRMAN STEIN: All right.

Again, I want to say procedurally that the reason I asked the question so generally is that I am acutely aware the case is in the Federal courts. That is why I can't go into details on this. But I invite comments.

MR. VANDERHOOF: General Hatch, I have one question. Did I hear you question the availability of technology for municipal waste treatments?

GENERAL HATCH: No. I said that technology is not conclusive on the tradeoff between diversion and advance treatment. The answers as to when and where it is advisable to use one versus the other is something on which there are some unknowns.

CHAIRMAN STEIN: By the way, you handled that very well, because that is one of the most vexing problems we have, and you are exactly right.

One of the problems with diversion of which you are probably aware, but haven't brought up, was this vexing legal problem of getting water from one river basin to another. Everytime you don't treat waste at the source, you are faced with that problem.

When you showed that slide for the place with the secondary treatment -- well, I think Texas should be commended on the slide, as you indicated.

You will see most of the places are those which have relatively large groups of population and very little water, and are not able to shift this from one basin to another. That is why, in order to live, you just have to provide secondary treatment if you are going to drop that at your doorstep.

But we do have a tremendously difficult legal problem in trying to get any kind of water, even treated water, one way or the other.

I know people bridle sometimes when you

talk about Lake Tahoe. I don't want to bring this up for any other analogy except to say at Lake Tahoe we discovered you couldn't put any waste in that water, treated or untreated, because the waters were so pure. We had to pipe it out of the basin. We were pioneering tertiary treatment or advanced waste treatment. That was hard, but that wasn't nearly as hard as getting the water out of the basin and putting it into the Truckee River drainage area. That was the most difficult problem we had, and it took years until we could get that to rest.

And again, I just bring this up as a factor, when you are talking about diverting waste from one river basin to another, sometimes some of you may want to look at that Great Chicago diversion case. I spent 20 years of my career on that alone.

MR. YANTIS: To get back on the subject, Lake Tahoe has very few oysters in it. (Laughter.)

CHAIRMAN STEIN: I knew I shouldn't have mentioned this. (Applause.) I have had some of the best mountain oysters around Lake Tahoe. (Laughter.)

MR. YANTIS: Now that you have brought up the subject, I wonder if the Denver Mafia was writing about bay oysters or mountain oysters in its black book in its figures.

The next speaker for the Texas Water Quality Control District No. 50, which is a small semi-municipal type government that we use in Texas, is Mr. Sal B. Lamprose and he has asked for time to make a brief statement. I do not know on exactly what subject, but he has been so interested in the waste problem and Clear Lake problem, I think it is appropriate to hear from him at this time.

MR. SAL B. LAMPROSE
TEXAS WATER QUALITY CONTROL DISTRICT NO. 50
SEABROOK, TEXAS

MR. LAMPROSE: Thank you, Hugh.

Chairman Stein and conferees of the board and ladies and gentlemen. My subject is going to be research and the role a small community is playing in water quality.

Much of what I am going to say here has been touched upon, some by General Hatch and some by you, Chairman Stein.

A few years ago, the Texas Water Quality

Board, through community hearings brought our attention to the degradation of the water quality at Clear Lake.

The Clear Lake area, a few years ago, amounted to cattle-grazing ground with the exception of a few resort areas around the lake.

It is now, I would think -- the population is up around 50,000 or 60,000. So this growth took place during the growth of the Manned Spacecraft Center by whom I am employed. I am also President of the Water District of El Lago, which is a community of about 2,500 people and the residence of most of our Apollo astronauts and the former home of Neil Armstrong, the first moonwalker.

I work at the Manned Spacecraft Center, and I am involved in environmental control systems on spacecraft. So working in the Water District on water quality was sort of my meat. I was primarily involved in research.

When the Texas Water Quality Board told us that we might have to divert all of our effluents out of the Clear Lake area and also indicated there was a possibility of going to tertiary treatment -- that term was new to us -- we didn't know what it meant.

We had heard there was some work going on at Lake Tahoe. So, in addition to other activities, I decided it was worth the trip to go up and see what it was all about. (Laughter.)

Well, I won't talk about what I did up there. But when I came back, I reported to my board they had a pretty fine facility up there, and they were making beautiful effluents, but siphoning it out, as you indicated, across the mountains and watering alfalfa and putting little fingerlings in and telling us how nice the trout were.

I didn't eat any. But they showed us some. I made inquiries to Hugh Yantis of the Texas Water Quality Board, and Mr. Fleming. I said, "What can you tell us about advanced waste treatment?" And he said, "Nothing. We don't know any technology on it." That has been 2 or 3 years ago.

I journeyed to Cincinnati to the advanced waste treatment plant and met fine people. It is quiet and telephones weren't ringing. I happen to be the first municipality inquiring about tertiary treatment in the whole country.

They gave me a lot of time and conversation and said they couldn't really tell us much about our particular design, and that maybe we would like to propose an application for a Federal cost share grant to develop something there they had worked out in the laboratory.

We did this and were successful in obtaining the Nation's first research development and demonstration grant for advanced waste treatment of our design in the whole country. That has taken place in Clear Lake.

We currently have a schedule to complete this facility by late next summer. Milestones are to have our phosphorus removing equipment completed by August of this year, nitrification by December and denitrification by August of next year in time to meet the Order 69-9A time deadline."

So we hope by this particular design to remove 90 percent of all the BOD and 90 percent of the nitrogen, and 5 mg/l BOD would be the maximum amount that we would discharge.

Suspended solids might reach zero, if our filtration works as we think it will. Now, at the present time, we are in the design phase for the phosphorus removal. In addition, while we were thinking of all this advanced waste treatment, we listened to Dr. Stephens up in Dallas in January, and he sort of inspired us and said that water recycling is the coming thing or you run out of water.

So, when I called to find out if there was any Government cost or money to do this, I was told no they didn't have any money. The research budget has been cut and we can't really spend money for this type of thing.

Well, this has been reversed fortunately, and we are working with the Baylor College of Medicine here in Houston, the Department of Virology and Epidemiology, on a process that they have developed that will be able to remove bacteria and viruses out of sewage water. That is untreated sewage.

So we are talking about putting this at the end of an advanced waste treatment plant and possibly closing the cycle, closing the loop.

We are real excited about this, and we feel that we have received excellent cooperation from our State and Federal Agencies on this. It is a small town and actually doing big business and important business. We are fortunate to have four members of our board being engineers in aerospace and civil and chemical and what have you.

It is a rather unique situation, but we are going to take advantage of that unique situation and do what we can to promote water quality.

Also I would like to mention the whole general community has funded a project which General Hatch mentioned, and that is the High School Student Program.

That has excited us because it puts a little flavor to some of the work we are doing. We see these young minds who are interested in doing something and becoming involved, and we are going to give them a job and pay them and direct these people.

The Gulf Coast Waste Disposal Authority and the Earth Awareness Foundation -- you probably haven't heard that term before, but this is a group also concerned about ecology, a non-profit organization that is coordinating this effort -- service clubs, private citizens, industries, water districts and municipalities are all taking part in this.

I have had a little bit of experience in collecting contributions to this thing. It is not easy, but I think that after this is over with and they see the results that the students can provide, that it is going to be looked at with a considerably better viewpoint.

The Environmental Engineering Department at the University of Houston is directing this effort so that the data we do gather will have quite a bit of credibility.

Finally, I would like to inform you ladies and gentlemen, and you, Chairman Stein, about the attempt by the water district to inform others of the advanced waste and water recycling program we have. When you do these things, nobody really knows too much about them unless you tell them.

One of the problems in the space program was we didn't tell everybody what we were doing and got a budget cut I think. (Laughter.)

CHAIRMAN STEIN: That just came about after you got on TV.

MR. LAMPROSE: I was referring to the type of advantages and benefits that were derived --

CHAIRMAN STEIN: I am just teasing.

MR. LAMPROSE: -- that are derived from the scientific advancements.

We are going to try to make use of the Environmental Education Act that was passed last year, which provides cost care funds to disseminate environmental education information.

We have applied for this grant, and we feel that we have a good chance in getting this grant. It doesn't amount to a lot of money, but it will make possible the dissemination of this type of information.

I mentioned before -- and I want to reiterate again -- that our cooperation from every level of government, including our own local citizens, has been excellent.

I think that if we can work cooperatively together on these problems on water quality, we can and will achieve the satisfactory goal here.

Thank you very much.

(Applause.)

CHAIRMAN STEIN: Thank you. May I ask just one question?

MR. LAMPROSE: Yes, sir.

CHAIRMAN STEIN: You talked about disseminating information. I would really like to know the reaction of your community. Did you tell them about the closed-loop system?

MR. LAMPROSE: Which system?

CHAIRMAN STEIN: Closed-loop system that we are talking about.

MR. LAMPROSE: Yes, indeed. One of our board members is quite active in one of the church communities there, and he took it upon himself to query housewives, and he was very much surprised. At first, he was very much against moving into this. We don't plan too rapidly. We are talking in the range of a 5-year program.

CHAIRMAN STEIN: I understand.

MR. LAMPROSE: He was surprised. He said that most of them felt that in controlled conditions, this is what we must do. They were just completely surprised.

CHAIRMAN STEIN: I would be interested in the results of that because that is of really vital concern to us.

MR. LAMPROSE: Yes.

CHAIRMAN STEIN: Our technical people can talk to you --- I don't want to take the time up here -- and possibly get the results of the reaction of the people. But one of the big problems we have is the aesthetic reaction of the people.

MR. LAMPROSE: We recognize that.

In the Space Center we had a 5-gallon refined purified urine sample and nobody would touch it, even though the characteristics appeared to be very pure. We plan to follow a very carefully regulated program.

CHAIRMAN STEIN: Right. Thank you.

MR. YANTIS: Well, according to my watch, it is 5:00 o'clock and I know the reporter is tired. But I did have 3 other people. I don't see how I can possibly take them all. I might take 2 of them.

Jerry Coleman, how long did you plan to take and where are you? Jerry Coleman, are you back there anywhere? (No response.)

Since he does not seem to be, we will plan on him for in the morning. But Cecil Reid of the Sportsman's Club of Texas wanted 1 minute. He might take about 90 seconds.

And then Ed Falk, who is a very newcomer to this field, wanted a couple of minutes. So let's try to finish up with those 2.

Cecil Reid, are you here?

While Cecil is walking up, I will say he is a trained biologist and worked for a number of years with the Fishing Commission of the State Game and Fishing Commission and has, ever since I have known him, been an Executive Director of the Sportsman's Clubs of Texas.

Cecil Reid.

MR. CECIL REID
EXECUTIVE DIRECTOR
SPORTSMAN'S CLUBS OF TEXAS
AUSTIN, TEXAS

MR. REID: Mr. Chairman, I am Cecil Reid, Executive Director of the Sportsman's Clubs of Texas. We headquarter at 311 Vaughn Building, Austin. The organization is made up of more than 90,000 members who are concerned with natural resource conservation.

It is understood that this conference is to direct its interests principally towards pollution in Galveston Bay.

Other than industrial and municipal waste, bottom disturbances can and do cause pollution. The term "pollution," according to Webster's New Collegiate Dictionary, means "to defile or desecrate." Therefore, to be reasonably accurate, anything which would tend to destroy the environment could be described as pollution.

In the process of dredging shell, silt is washed out of shell and shell particles are allowed to drift with the currents and the tide. In this manner, live oysters have been covered and, of course, suffocated. Increased turbidity reduces basic organisms' production, which, in turn, reduces the fish and shellfish production.

It is not necessary we destroy the bay and estuarine environment in order to mine shell as a source of shell carbonate. There are thousands of limestones that can be obtained and used as well as oyster shell. Shell is a nonreplenishable resource and shell mining has a drastic and destructive effect on nature.

Nursery grounds are covered by mud and silt, and nanoplankton and phytoplankton, which are the most basic lives in the water, are destroyed, which means breaking down the food chain for the food fishes.

Oyster shells have been dredged in the bays for about 70 years. During all of those years, we have been destroying the bays and estuarine environments. The least we can do now is preserve those few remnants of reefs that now exist.

The food and game fishes must have clean waters for feeding and for nursery areas. The production of these species are of economic and recreational importance to the citizens of this country. We should utilize our natural resources for the benefit of the greatest number of people and for the longest period of time. Productive bay bottoms cannot exist where destruction occurs.

Mr. Chairman, it is hoped this conference can find some means of stopping the dredging of the shell in this State and reduce the shoreline changes that are brought about through bulkheading and filling.

On behalf of the Sportsman's Clubs of Texas I want to thank you for this opportunity.

CHAIRMAN STEIN: You have raised an issue I haven't heard before here, in this case.

By the way, I think that bulkhead dredging and fill of the shell is very common. I raise the question as to why it wasn't in the Federal or State presentation so far? We will certainly take that up. Thank you for raising the question.

MR. YANTIS: There is a whole body of law about the subject Mr. Reid spoke about, and it is not directly related to pollution and to the harvesting of shellfish. But it is a valid subject and a specialized subject.

Now, I may have changed my signals again. Ed Falk just sit quiet a minute.

I am reminded I promised earlier Jim Quigley 5 minutes, which knowing him -- do you want to change your mind again?

MR. QUIGLEY: was trying to indicate if we were going to start at [illegible].00 o'clock tomorrow instead of 9:30?

MR. YANTIS: 9:30. Is there a reason?

MR. QUIGLEY: It is a matter of an airplane.

That is all right.

CHAIRMAN STEIN: Tell your private pilot to sleep in. (Laughter.)

MR. QUIGLEY: If he has to sleep in, he will get another job.

MR. YANTIS: Ed Falk, we will close with you, and while you are coming up, I want to tell the people what the Clear Creek Basin Authority is and explain it just a little bit. I feel that this explanation is needed.

The Clear Creek Basin Authority was the first authority of its kind organized in Texas. But it was not organized the way it was originally thought it needed to be. It was restricted to 1 county instead of 2 and didn't have any taxing powers, etc. It had no income, no nothing. It did have a Board of Directors who tried very diligently and very unsuccessfully to do a great many things in cooperation with us. Some things it did do. It did help us in holding some community meetings. It helped us in bringing about some reasonable planning. But on the average, it never quite was able to do the things that had to be done, however valiantly it tried.

Then the Gulf Coast Waste Authority was organized. Many people felt that the Clear Creek Basin Authority was then no longer needed. It was my view that there was a place for both of them.

The Gulf Coast Waste Authority has now been amended, and it does have more authority than it used to have, especially to designate small areas for regional system construction, I think taxing power and so on. Again the question was raised, "Do we need the Clear Creek Basin Authority?" Immediately we thought we could do without it, but, as long as the people of the area want it, there is the thought it ought to have a a chance.

So, Mr. Ed Falk is now President of the Clear Creek Basin Authority and has, I believe, a group of new directors. He has a new attorney. He has a new engineer. To the best of my knowledge, none of them have been involved in water quality work before. They are, however, interested in their area, and they are interested in government and interested in problem-solving.

Now, I had never met Mr. Falk until a few moments ago. I do not know what he will say. But he did ask time to make some comments on behalf of the Clear Creek Basin Authority.

MR. ED FALK, PRESIDENT
CLEAR CREEK BASIN AUTHORITY
PASADENA, TEXAS

MR. FALK: Thank you.

You cut my time from 5 minutes to about a minute and a half now. I want to preface my remarks that in El Lago nobody told me about a "closed loop." (Laughter.) I better go to church a little more often.

My name is Ed Falk, and my degrees are in economics, business and political science.

I do not work for any of the petrochemical companies, and, as you pointed out, none of the present members of the board are members of the petrochemical complex.

When this board was first started in 1965, 14 of the 15 members were directly employed by the petrochemical complex in Texas. This board had no chance of success. In fact, the present board members, including myself, feel that the board was created not to succeed. It was a veneer to show the taxpayers and these citizens that they were going to do something about pollution. Now we are talking about 1965, not 1969 or 1968 or 1970.

We were given no enforcement powers. We were given no taxing powers, and as you pointed out we were given 1 county -- which means if you look at these charts enough, Clear Lake is divided between Galveston County and Harris County. In other words, we were told to clean up half a lake. (Laughter.)

Similar to the zoning in the Houston Ship Channel, the water will stop at Zone A and not proceed on to Zone B. (Laughter.) Which was an impossibility.

We have one distinction which no water authority has, including the Gulf Coast, and that is we are elected by the people. We are not appointed. We are one of the few State agencies that are elected. When the word "ecology" became a favorite pastime of many, many people and they became interested in pollution and in the cleaning up of Clear Lake, they took a look to see what the Clear Creek Basin was doing and found out they were holding meetings and not doing anything.

They also found out that you can be elected to the board; you don't have to go through the political bureaucracy to get appointed. So we turned around and got elected to the board a year ago, and I was elected as a director with 4 or 5 other directors, mostly from NASA -- engineers and administrators. At that time, we started talking about filing lawsuits. We are not afraid to file lawsuits. We want to file them today.

The board at that time was comprised of Fred Dorhnheim, who was President of the board and who was the number two man at Atlantic Richfield, and other people who were mayors of the various municipalities or with the petrochemical industry. When it became apparent that they did not have the power to abolish this board -- I'm sorry, when they found they did not have the power to control the thinking of the board anymore -- they attempted a resolution to abolish the board. This failed. It was tabled and effectively killed, at which time Mr. Dorhnheim pulled out a resignation and resigned from the board, taking with him his engineering firm -- Brady, Turner, "ad nauseum" -- with him, including his counsel, who has represented polluters far more than he has represented antipolluters and members of this board.

We appointed new members. We had a new election. In fact, we had contests for the election. We had 15 members on the board. Most of them are NASA engineers. The counsel serves free. The engineering firm serves as a civil endeavor for free. We have the advice of NASA engineers to guide us in our deliberations.

We have questioned the need of a regional sewage service. We don't think one is necessary. We don't believe in diversifying the treatment to another area. We believe in tertiary treatment, as many of the districts are doing.

We question also how one agency can have both the power to operate this system, and the same agency is going to monitor the system and be the same agency that is going to do the enforcing of the system. Who is going to enforce the enforcers? Who is going to police the police?

This is why Hugh says there are some people in the area who say the Clear Creek Basin Authority serves a very useful function and should remain.

I am one of those who enforce the enforcers, and you will find tomorrow, when you hear the citizens groups, a great many others along these same lines. You will find Professor Art Busch who will talk about building holding tanks. They (holding tanks) are a very economical way to clean up the pollution without having to go to large, expensive systems, and without having to take the windfall and give it to engineering firms, or take hard-earned taxpayers' money for this purpose.

We find that our counsel has told us you cannot file suit -- a State agency cannot file suit unless you get permission from the Water Control Board or Water Commission or Attorney General. In fact, this will not hold up, because our powers are vested in the State, and not being an attorney, I won't delve too deeply into it. We don't have the monies to go into this type of court action.

I will state one example to illustrate the point. There is a water district, WCID 60, which was the El Cary Water District, which was asked if it could have a permit from the Water Quality Control Board. It was turned down because the system wasn't adequate. It proceeded to operate without a permit and, indeed, in fact, it added onto its system.

The Water Quality Control Board went to the Attorney General of Texas to prosecute. That paper is still sitting on the Attorney General's desk 2-1/2 years later. Nothing is being done. They are still dumping. They are still working without a permit, let alone a variance on the permit.

They have now been absorbed by the city of Pasadena, so that the problem is now compounded and is probably even worse than it was before.

Let me conclude by saying the Basin Authority wants to cooperate with the Gulf Coast Waste Authority, the Texas Water Quality Board and anyone upon layers upon layers upon layers of agencies that have been created by the State.

Last, of course, we want to cooperate completely and fully with the EPA, because we feel this is the only avenue where something will be accomplished. And as an unconstituted Republican, I hate to see Federalism come in here, but I really don't see any other way. And I thank you for the time.

Hugh, I hope you are not disappointed. (Laughter.) (Applause.)

MR. YANTIS: Ed, I don't know why I should be disappointed. I think there is nothing I enjoy more than an opportunity for a good argument.

However, being that it is 5:15, unless the Federal people have a question, this is beyond the time where the secretary had agreed to work.

CHAIRMAN STEIN: I don't have a question. I was wondering how long we have to wait here until we heard a statement of that kind. (Laughter.)

MR. YANTIS: No. We always encourage the people of Texas to speak out. (Laughter.) We know they are going to do it anyhow. Quite often, they have something worth listening to. I think there is a lot of merit to what Mr. Falk said. There are some things I think I disagree with, but there are a lot of things that he said that I think are worth listening to. But we could philosophize on that all night. So unless the Chairman of our board here has a closing statement, I guess we will end on the thought for the day that a bass drum only makes noise when it is empty.

We will see you in the morning at 9:30.

(Whereupon, the conference recessed until 9:30 a.m., June 9, 1971.)

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